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THE AMERICAN GAS LIGHT JOURNAL

ROMANA, KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XLIV.—No. 1. Whole No. 637. | NEW YORK, SATURDAY, JANUARY 2, 1886. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager
JOS. R. THOMAS, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

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IN REGARD TO THE HARTLEY FUND.

In the last number of the JOURNAL an appeal was made to the American gas fraternity on behalf of the children of the late Mr. F. W. Hartley, who, through his sudden decease, were left in a condition far removed from that state of safety which would have been guaranteed by the division amongst them of a very modest proportion of this world's goods. Unfortunately the deceased engineer had but little to bestow upon his children in a financial way. He had brought them up carefully, and the effects of his judicious training is now made manifest by the sturdy style in which the older ones of his brood have accepted the responsibilities so suddenly and lamentably thrust upon them. Still, while their efforts are sturdily and earnestly put forward it must be remembered that the family is a large one, and contains an all too large proportion of members whose sex or tender years precludes them from contributing much towards the common fund. We wish it to be distinctly understood that this idea of creating a "testimonial fund" for the benefit of Mr. Hartley's family arose in a perfectly spontaneous manner. The friends and co-workers of the deceased engineer concluded that his teachings and labors were of such a nature as to make them his debtors, and in this, the sore hour of his family's deep affliction, they sought, in a practical, graceful and lasting manner to cancel a portion of the debt. So much for the spirit that animated his English brethren in their desire to make less rugged the pathway of Mr. Hartley's family; and now for our own reasons.

Possibly some of our readers may be inclined to question the course taken by us; and if there be any such doubters among our patrons we can only say we instituted this section or division of the fund because we thought, and still think, that Mr. Hartley, through his frequent and excellent contributions to the gas literature of our time, has caused as many to be indebted to him in this country as he did at home. We felt sure that our American fraternity would be anxious to assist their English brethren in a joint labor of love, and we experience a similar feeling still. Those who have responded to our preliminary appeal have done so in an unhesitating manner; and while we have no intention of publishing the letters that accompany the remittances, we cannot forbear from mentioning that the Indianapolis Company's check was handed in with the words, "This Company feels, in sending this amount, that it is only for value received." We repeat those words simply because they thoroughly express our own views in the matter. The following is an alphabetical list of the subscription amounts so far received:

American Meter Co., Phila., New York, Chicago, etc.	$25 00
Callender, A. M. & Co., New York city	25 00
Down, W. H., New York city	5 00
Egner, Frederic, St. Louis, Mo.	20 00
Gregory, G. H., New York city	5 00
Hopper, T. C., Phila., Pa	10 00
Indianapolis (Ind.) Gas Co., per Jas. Somerville	50 00
Society of Gas Lighting	25 00
Stout, John, Chicago, Ill	10 00
Thomas, Jos. R., New York city	10 00
White, Capt. W. H., New York city	10 00
Whyte, Wm. C., New York city	2 00
Total	197 00

The contributions to original or English fund have been made with promptness and liberality, and a substantial sum has been secured. The period for closing the same was fixed at date of December 12th, 1885; and we have therefore decided to close the American section with our issue for February 2d. If our fraternity will take hold of the matter in earnest, each one subscribing but a sum in itself trifling enough, they will have the satisfaction of knowing that the aggregate amount will do credit to themselves as a body, and bear noble testimony to their willingness to do honor to a brother's memory.

DEATH OF MR. PAUL HENDRICKS.

Happening so soon after and from causes so closely resembling those that attended the decease of a near relative (late Vice-President of the United States), the death of Mr. Paul Hendricks, of the Madison (Ind.) Gas Light Company, has attracted widespread attention. But whatever be the cause

that attracted the attention of the general public to the demise of the Secretary of the Madison company, those of the fraternity who were acquainted with the deceased needed no such magnet to reach their sympathies and shock them with the thought that their friend and brother was no more. The subject of this brief memoir was born in Madison, Ind., in 1832, and was the son of Wm. Hendricks (who was himself a central figure in the history of Indiana State politics and politicians), and traced his maternal ancestry back to the days of Col. John Paul, who was the actual founder of the town of Madison. He was closely identified with the business interests of his birthplace, perhaps the most prominent of his early ventures being a partnership with his father-in-law, Mr. Samnel Crawford, under which they jointly controlled the fortunes of the Indiana Foundry Company. He joined the Union army at the outbreak of the rebellion, and served with distinction as an officer in the 22d Indiana regiment. Upon the death of Mr. Jas. Siddall Mr. Hendricks succeeded to the Secretaryship of the Madison Gas Company, and of him it may actually be said that he died in harness; since it was while engaged in conversation with Mr. H. B. Foster (President of the Company) that a fatal stroke of apoplexy seized him. Our Western correspondent, on page 12 of present issue, alludes to some of the matters with which Mr. Hendricks was connected, and so no need exists for their duplication here. Brave, prudent and manly, Paul Hendricks leaves to us the records of a life well spent.

ANNUAL MEETING OF THE SOCIETY OF GAS LIGHTING.

The Eleventh Annual Meeting of the Society of Gas Lighting was held in New York city on afternoon of Thursday, Dec. 17. The attendance was gratifyingly large, and the proceedings were more than usually interesting. The President alluded briefly to the most important features of the Society's doings during the year 1885, and then the annual reports of Treasurer Armington and Secretary Benson were presented and read. Both official documents submitted substantial reasons why congratulation should be indulged in on the part of the members. The Society has adhered steadily and progressively to the matter of furthering the aims of its founders, and its advance has been gained solely through the united concert of action that always prevailed among its members.

The annual election for officers resulted in the selection of the following gentlemen:

President.—Jos. R. Thomas.
Vice-President.—Eugene Vanderpool.
Treasurer.—James H. Armington.
Secretary.—Frederick S. Benson.
Member of Executive Committee.—Alfred M. Smith.
Finance Committee.—Wm. Coombs, Dudley D. Flemming, and C. H. Coggeshall.

The following schedule shows the order in which members will be called upon to present and read papers during the sessions of 1886:

January—Messrs. Theobald Forstall, Wm. Farmer, and F. C. Sherman.
February—Messrs. G. D. Cabot, Thos. Turner, and C. D. Lamson.
March—Prof. C. F. Chandler, and Messrs. E. Vanderpool and S. G. Stiness.
April—Messrs. Wm. Coombs, James H. Armington, and O. E. Cushing.
May—Messrs. J. L. Hallett, C. H. Coggeshall, and A. B. Slater.
June—Messrs. William Mooney, M. S. Greenough, and Jos. R. Thomas.
Sept.—Messrs. C. J. R. Humphreys, F. A. Sabbaton, and A. M. Smith.
Oct.—Messrs. A. Strecker, W. A. Stedman, and D. D. Flemming.
Nov.—Messrs. C. H. Nettleton, F. S. Benson, and Prof. Henry Morton.

From this disposition it will be noted that in the months of July and August, as also December, no papers will be received; and is in accordance with a resolution passed at last annual meeting. The Society resolved to donate $25 to the American branch of the Hartley fund. An animated discussion on topics connected with the gas maker's craft was indulged in, and when the hour for partaking of the annual dinner was announced, the members, with a unanimity quite in contrast to that displayed during the progress of the technical discussions, proceeded to "absorb" the same. The Society enters upon its twelfth year with every indication that the work of the past will be sustained and confirmed in the records of its future.

THE PEOPLES COMPANY ALSO "ABSORBED."—Our last issue contained the particulars concerning the purchase of the plant and franchises of the Albany Gas Light Company by the promoters of the Municipal or opposition corporation. It was rumored at the time that the owners of the Peoples Company—the latter operated in the northern district of the city—would likely contest the matter of supplying gas with the Benedict combination; but the rumor was strangled on date of Monday, Dec. 15th, when the Municipal controllers succeeded in acquiring all the Peoples stock, and also a majority of the bonds.

[OFFICIAL REPORT—Continued from Vol. XLIII, page 317.]

Thirteenth Annual Meeting of the American Gas Light Association.

HELD AT COLLEGE HALL, CINCINNATI, OHIO, OCT. 21, 22, 23.

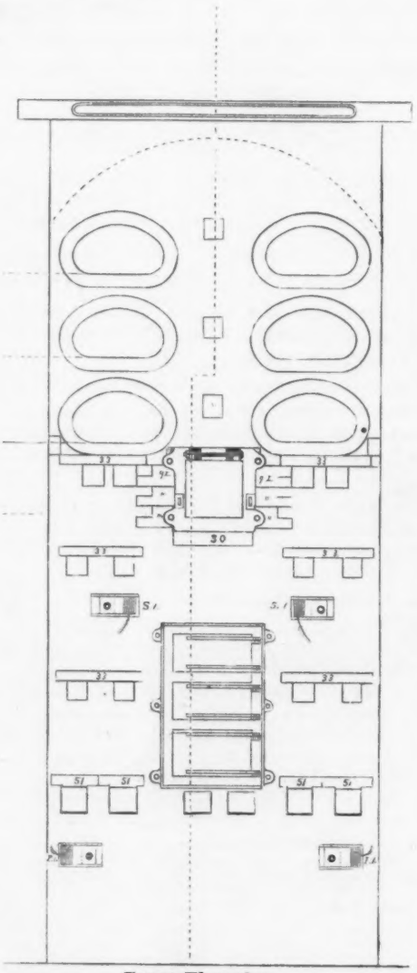
SECOND DAY—MORNING SESSION.—THURSDAY, OCT. 22.

Mr. A. C. Wood, of the Syracuse (N. Y.) Gas Light Company, was the next contributor on the Secretary's list. Mr. Wood's paper was on the subject of

IMPROVED FURNACES,

and the author read as follows:

Mr. President and Gentlemen of the Association:—At the Annual Meeting, in May last, of the Central New York Gas Engineers' Association, I gave the members thereof a description of the new plant erected by our company during the previous year.



Front Elevation.

In that description I related our experience in the working of the "Stedman-Stanley Furnaces," and reported the results obtained after using them up to that time—some four and one-half months. This statement was published in the AMERICAN GAS LIGHT JOURNAL,*† with the proceedings of the Central New York Association; and when, a few weeks ago, our worthy President and irrepressible Secretary importuned me to present for your consideration a paper bearing upon this same subject I declined, stating that as I had already given our gas friends our experience with regenerative furnaces, and that the information I could impart was in the hands of all who read the JOURNAL, it was neither desirable nor expedient to repeat it.

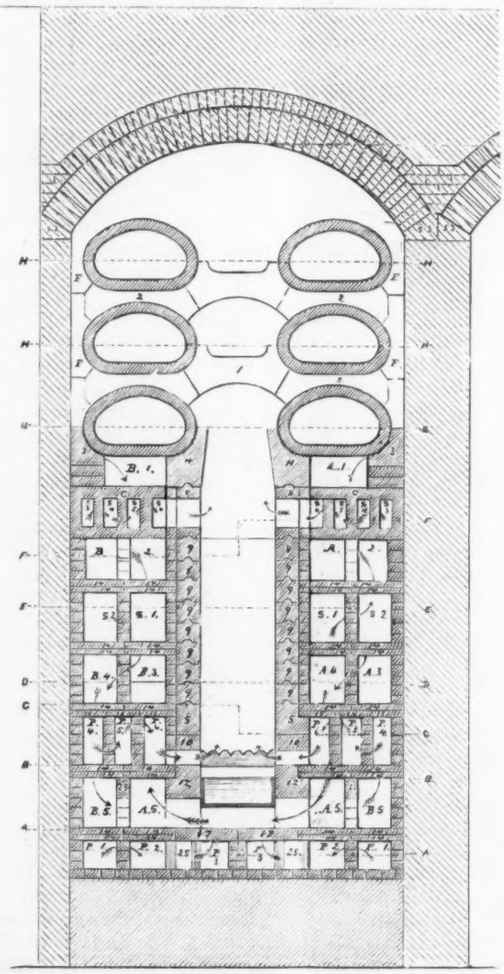
The reply was, five additional months' use of the new furnaces had elapsed since the meeting of the Central New York Association, and that a statement brought down to, say, October 1st, giving our experiences with the furnaces during the nine months' of use, would be of interest to the mem-

* See issue for July 16, 1885, pp. 37-8.
† For other descriptive papers of the Stedman-Stanley furnace, see JOURNAL, Vol. 31, issue of April 16th, 1883, pp. 174-5; also Vol. 39, issue of Nov. 16, 1883, pp. 222-3.

bers of the Association, and the President then directed me to prepare such a statement and present it at this meeting.

I have therefore obeyed his orders, and will proceed to give you our working experience with the "Stedman-Stanley Regenerative Furnaces," for nine months, ending Sept. 30th, 1885.

In the paper before alluded to I gave a description of the construction and modes of operating these furnaces, which need not be repeated here. Suffice it to say that the Stedman-Stanley furnace aims to utilize the waste gases, which have left the retort chamber, to the fullest extent consistent with strong and durable construction; and before permitting them to pass away into the chimney they are conducted back and forth between the front and rear ends of the bench, in contact with a series of parallel flues, from which the air for combustion is supplied. The flues for heating the air for the combustion of the furnace gases are uppermost in the series, and consequently are subjected to the greatest heat. The air for the combustion of the coke is heated in the lower series of flues, and the waste gases are finally conducted, transversely, under the ashpan, and evaporate water to furnish the steam necessary to keep down the clinkers and mitigate the intense heat,



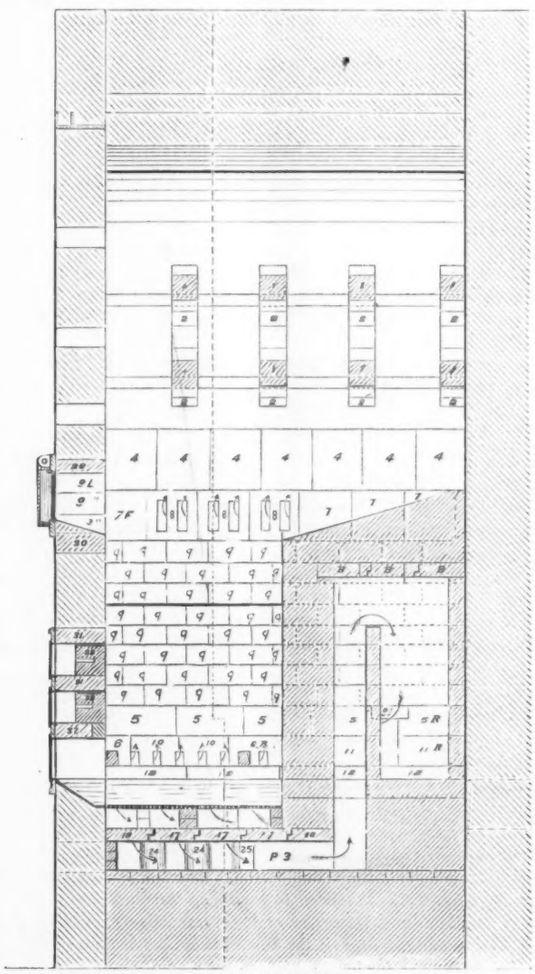
Section K. K.

which would otherwise destroy the furnace linings. The steam as it rises from the ashpan mingles at once with the heated air from the primary air flues, and together they ascend through the body of the coke in the furnace.

Referring to the cuts, the waste gases are lettered *A* on one side and *B* on the other; and at the flue below the ashpan it will be seen that they appear on both sides. The supplementary air flues are lettered *S*, and the primary air flues *P*. The numbers indicate the successive flues into which the waste gases, and also the air supplies, successively pass. The furnace is made of various depths, to suit the structures where it is built. Not less than 3½ feet in depth of fuel can be relied on, however, for generator work. The deepest furnace is in a basement of 13 feet height, and the shallowest where an excavation of only 3 feet could be allowed. In this case, by raising the inlets to the supplementary air supply sufficient space was made between them and the grate bars to maintain a good working depth of fuel and produce excellent results. A greater depth of fuel insures more uniform quality of the gases from the generator.

The retorts are 14 in. by 26 in., and 9 feet inside, six to each bench; and a stack of seven benches was erected. On December 11, 1884, we charged, for the first time, three of these benches. These three benches have been under continuous fire from that date up to the present time. Others of the benches, put in use in December, January and February, were let down later in the season. The average number of retorts in daily use for the whole period was 20⅓. About 63 per cent. of our whole make of gas was made in the new benches, the balance being made in ordinary benches with ordinary furnaces. As our whole make of gas passes through the same station meter, we can only credit the coal carbonized in the new benches with the yield of gas obtained from all the coal used; so, upon this basis, we give you the production of gas in the new benches.

The yield of gas per pound of coal used for our whole make, for nine months ending Sept. 30th, was 5.072. We know that the yield was more than this in the new, and less than that amount in the old, benches, and that at least 5 per cent. could be safely added to the above yield for the production of gas in the new benches; but we will take the figures as they are without any estimates or speculations. With this understanding we have



Section J. J.

the following results, obtained in operating these benches with the improved furnaces, for nine months, from Jan. 1st to Sept. 30th inclusive. The amount of coal carbonized was 10,640,942 pounds; the number of days was 273; average number of retorts in use, 20⅓; average charge of coal per retort, 316⅔ pounds; average charge of coal per bench, 1,900 pounds; average charge of coal per bench per day, 11,400 pounds; the amount of gas manufactured was 53,970,858 cubic feet; the average yield of gas per pound of coal, whole make, 5.072 cubic feet; average yield of gas per retort per charge, 1,606 cubic feet; average yield of gas per retort per day, 9,636 cubic feet; and average yield of gas per bench per day, 57,816. The coal used was Westmoreland, with an average of 5.3 per cent. of West Virginia cannel, which gave us an average of 19.3-candle gas, tested with an ordinary Argand burner. This gave us, per retort per day, 185,975 candle feet, and per bench per day, 1,115,850 candle feet. This production would have been increased but for reasons set forth in the statement before alluded to—*i. e.*, "There were many interruptions in the working of the new benches incident to start-

ing up and operating a new and comparatively untried apparatus;" and, too, for reasons given, we were unable to keep the benches in steady and uninterrupted work.

This is clearly shown in results obtained for the month of June, when 76 per cent. of the gas manufactured was made in the new benches, with a less number of charges missed during that month than in the statement before us for the nine months.

During the month of June there were carbonized 971,272 pounds of coal, which yielded 5,235,156 cubic feet of gas; the average yield was 5.39 cubic feet of gas per pound of coal carbonized.

The average number of retorts in use was 16½; the average charge of coal per retort was 327 pounds; the average daily make of gas per retort was 10,576 cubic feet; and per bench, 63,450 cubic feet; four per cent. of cannel was used, and the gas 19.5 candles; the production was 206,232 candle feet per retort, and 1,237,275 candle feet per bench per day.

The furnaces are easily operated and fully under control; and, with proper attention, result in almost entire freedom from clinker. If a continuous supply of water is kept in the ashpan the fires will not require clinkering oftener than once in 5 or 6 weeks; but if the ashpans are allowed to become dry clinker will accumulate rapidly, and in an hour or two the fires will be choked.

Our record shows that the fires of the three benches, charged on December 11, 1884, and in continuous use up to the present time (Oct. 7, 1885)—a period of 300 days—were clinkered ten times only—or on an average of 30 days—during which time we had four interruptions to our water supply, and, in consequence, were obliged to clinker the fires in 12, 23, 11, and 27 days, respectively. The average time, exclusive of the four occasions mentioned above, was 37⅜ days, or 5.38 weeks.

The longest period over which we allowed the fires to run without clinkering was forty-four days. When clinkered the grate bars are drawn and fires let down. The clinker mass is found in a rotten condition—*i. e.*, it can be easily broken up and detached from the sides of the furnace. After the three hundred days' of use the furnaces are in as good condition, and nearly as perfect, as when built.

The grate bars are likewise in good condition, having never been changed.

Hot coke is fed directly into the furnaces from the two lower retorts in each bench, requiring about 25 per cent. of the coke made to run the fires. One man easily attended to the seven fires we had in use last winter, except on clinkering days, when he required some assistance—say, one-half to three-quarters of an hour for each bench at each time of clinkering. The man in attendance at the fires shakes the grate bars every four hours, removes the ashes from the pan, sees to the water supply, and assists in removing the hot coke into the yard. The fireman, aided by coke yard man, takes care of the hot coke, as it is received from the retorts, until quenched in the yard.

On the charging floor we work one man to each bench in each shift. They handle their own coal, and rake the hot coke from the retorts into cars below.

Thus, I believe, I have fully complied with the President's demands, and will take up no more of your time, hoping that I may be pardoned if I have necessarily repeated portions of my former statement before the Central New York Association.

The furnaces have given us entire satisfaction in every particular.

Discussion.

The President—We have listened to a most practical and valuable paper. It belongs to a class of contributions which, I think, would be much to our interest to have more of. It relates to a subject the consideration of which has done as much to develop the economies of our industry as anything else that has been presented during the last 15 years. I hope it will receive a complete discussion at your hands. There are a number of members present who have had experience with different kinds of generator and recuperative furnaces; and I will call upon some of them to take part in the discussion. I think Mr. Slater has had quite an experience with different forms of furnaces, and has obtained valuable results.

Capt. White—Before the discussion commences I would like to move that 1,000 copies of Mr. Wood's paper be printed and distributed amongst the members; also that illustrated drawings of the furnace be inclosed in the pamphlet. It contains most desirable information; and the aim of the motion is to save Mr. Wood from replying severally to the many calls that are sure to be made upon him for information in regard to the very matters contained in his paper.

Mr. Harbison—Mr. Wood, in his paper, states that he had previously read a paper upon the same subject which gave a more detailed description of the construction of the furnace than the one just presented by him. Many members of the Association would be pleased to have that description inclosed in the proposed pamphlet, even though the prior paper has been already printed in the Journal. It might add a few additional pages to the pamphlet, but I think the latter would be more valuable if the Secretary should be instructed to print the former article in connection with this. I therefore move that as an amendment.

Capt. White—I accept that amendment. It was my understanding that that course would be followed, as the paper read last May really forms part and parcel of the one we have just heard read.

Mr. Wood—The suggestion meets with my approbation, and for the reasons mentioned by Capt. White. Perhaps I may here fairly make a just criticism on the action of some of the members of our Association as gathered from experience. Members come here and listen to the reading of papers and to the ensuing discussions—although but few of them, comparatively, engage in said discussions—and afterward the proceedings are published in the American Gas Light Journal. Now, notwithstanding this fact, many members who come here do not seem, when the actual questions before discussed become of importance in their own particular working at home, to have remembered anything about what they heard and read. They cannot look the papers up; do not remember the time at which these were delivered; in short, apparently forget all about the question. I have scores of letters upon different subjects that were considered here and then printed in the Journal, as also in our published volumes of proceedings. I have been astonished that the writers of the letters were not just as well informed with regard to what they have written me about as I was myself; they certainly had sufficient opportunity to become posted. In regard to the matter of these furnaces, I have had inquiries from gas men all over the country requesting information as to the workings of the Stedman-Stanley system. Ever since that Central New York paper was published they have asked me questions which it fully answered. Perhaps, if the paper is now published in pamphlet form, and properly distributed, the members may give it a trifle more attention, and also have the information close at hand when needed. Possibly I may not then receive so many letters about the subject.

The motion, as amended, was agreed to, and the regular order of discussion resumed.

Mr. Slater—As most of you know, our experience at Providence, R. I., has been confined almost exclusively to the Dieterich furnace. I do not know that I can give any facts other than those already given by me before the Association on several occasions. Before leaving home I copied from our books an average of the results obtained this year; consequently the statement may show some improvement on what we have done before. At our West Station the lowest average yield for any one month in the present year was 10,984 cubic feet per retort; the average yield per pound during that time was 4.88. The largest yield for any one month (July) was 12,457 cubic feet—or a yield per pound of 5.22. Taking the first six months of the year, the average yield per retort was 11,217 cubic feet—or a yield per pound of 4.90. In the third quarter of this year our average yield per retort was 12,080 cubic feet—or an average yield per pound of 5.23. At the other station (where we have similar retorts) the lowest average yield during any one month was 9,993 cubic feet—with an average yield per pound of 4.92. The largest monthly yield (February) was 10,417 cubic feet per retort—or an average of 4.94 to the pound. I think, in the working of our furnace, there is probably more wear and tear than Mr. Wood experiences with his. He also has less expense for grate bars. We obtain a trifle more gas than he does. He reports quite a percentage of larger yield per retort, but with less candle power.

Mr. Wood—I think it would add value to the information if Mr. Slater would give the size of his retorts. The Association will be interested with his experience in working three-hour charges with an average of less coal, I think, than we use in our smaller retorts. Still, he burns it off in three hours while we burn it off in four.

Mr. Slater—I am not able to give, from memory, the square inch surface of the retorts; but they take the same arches as do the 14 by 22. They are what is known as the Davidson retort. Nearly two-thirds of the back end is wider than the front end. They take the same mouthpiece as the 14 by 26. We run three-hour charges exclusively.

The President—Have you got figures of coke consumption with you?

Mr. Slater—No; but I can say that, when the furnaces were new, we have been down to as low as 19 per cent. of coke by measure; when the furnaces become old, however, the percentage is increased somewhat.

Mr. Starr—What weight do you charge?

Mr. Slater—We are charging from 280 to 315 pounds every three hours.

The President—I understand that Capt. White has a letter from Mr. McIlhenny, of Washington, who has had a great deal of experience in the erection and manipulation of these furnaces. We would be very glad to hear the letter read.

Capt. White—I have, as you say, a letter from Mr. McIlhenny. Presuming the members of the Association would like to know what Mr. McIlhenny is doing with his furnace, I wrote him before leaving New York that if he would send me some facts I would, with the permission of the Association, submit them during this discussion. This is what he writes:

"WASHINGTON, D. C., Oct. 17, 1885.

"* * * * I have been unable heretofore to measure the coal and oil gases separately, owing to the fact that we have been rebuilding the purifiers for the oil works; hence both gases were run through the same purifiers, and I could not tell exactly what we were doing with the furnace benches. On the 6th of this month this condition of things changed, and the gases were again passed through separate meters. Since then the results have been as follows: Number of retorts in action, 90; charge per retort each four hours, 333 pounds; yield per pound, 4.98 cubic feet; production per retort per day, 9,960 cubic feet; consumption of fuel, 20 to 22 per cent. Furnaces are clinkered once in from four to six days. No pitch in main. Only six stopped stand-pipes on the 15 benches of sixes since they were fired up in July last.

"The figures that I have given are the daily average. Our retorts are 15 in. by 26 in. by 9 ft., inside measurement. A much larger charge might be burned off, but I have determined to adhere to 2,000 pounds to the retort per day as the regular charge. * * * *"

I saw these furnaces early in June, in August, and again three weeks ago. The most peculiar feature about the McIlhenny furnace system is that in the arch there is a very mild, mellow heat—scarcely what we would term a bright orange; and yet the charges are burned until all the gases are extracted from the coal. The gaseous fire in the retort arch is so complete, and the heat so thoroughly used up there, that there seems to be no heat at all radiating from the bench. I went up on top of the arches, and it was really quite comfortable under foot. You know that usually the top of a stack of benches is rather a warm place; but you could stand there without any inconvenience at all. You could place your hand upon the chimneys of the benches and keep it there as long as you pleased. There was no flame appearance above the chimney, and there was no flame in the arch, where the secondary combustion takes place. It seems to me that Mr. McIlhenny has at last got to the point of having an absolute regenerator furnace. Whether it is better, or not so good as other furnaces, I am not prepared to state. I have been very much interested in it; and as Mr. McIlhenny has spent a great deal of time and money in pursuing this subject, it seems to me we ought all to be glad to know that he at least has had some measure of success.

Mr. Slater—I would like to inquire whether Mr. McIlhenny builds a solid wall as the front wall, or does he build an air space?

Capt. White—There is an air space in the front wall. The front wall is 9 inches thick; then comes the air space; and the brick alongside of that is 4 inches, with a header running through.

The President—We would all like to hear from Mr. Greenough what has been his experience with the furnaces erected in the new works at Commercial Point.

Mr. Greenough—I suppose that every fond parent likes his own child better than that of anybody else. We have done a great deal of experimenting with the furnace, and finally came to the conclusion that, on the whole, we liked the fire outside of the bench better than we did under it; and also found it was better if the furnace was put behind the stack. In our new works we split our retort stacks up, and put the furnaces back. I must say that I see no better work anywhere than those furnaces have given us. We had them going all of last winter, and some have been going ever since. We used, at one time, rather more than 12 per cent. of cannel; since then we have been using oil. I do not carry the figures with me, yet I know that we have averaged, all through last spring, in the vicinity of 5½ feet per pound of coal, including oil: and about 11,000 feet per retort. We have had no trouble with our hydraulic main. We charge every four hours. The retorts are 15 in. by 26 in. by 10 ft.; and we put in about 2,000 pounds to the six retorts in four hours—using a drawing machine to remove the coke. Mr. Fullager said this morning that it took him about a minute to draw a retort. We find that we can do better than that; we take out twelve retorts in eight minutes. The chief point about Mr. Wood's furnace, as it seems to me, is in the rather simple adoption of Mr. Schilling's theory of vaporizing water by the use of the heat of the waste gases. Mr. Schilling's furnace is quite elaborate as compared with the Stedman furnace. There is no doubt that the use of the steam assists in the prevention of clinker. Somewhat the same result can be obtained by putting a little steam in the water of the ash-pan, but the effects are not so much. We tried a couple of the Stedman furnaces, but our success was not so good as was that of Mr. Wood. Of course, because one company fails, it does not amount to anything, provided another company succeeds. If a man succeeds in working the furnace, his testimony is valuable; if he does not, then his testimony is only negative. We supposed that the draught was not quite high enough in our furnace, and we have been endeavoring to remedy it. They have not heated in front in the same way that furnaces have when outside of the bench. Our results, therefore, have not been as satisfactory as those of Mr. Wood. We have also tried some German furnaces, which we imported in order to see how they would work. They are on a different plan altogether. They clinker very easily indeed. They work nicely, but no better, nor as well, as the furnaces constructed here. You can construct furnaces, with very little difficulty, which will largely increase your yield per retort, and thus make a saving. A furnace ought not to use much more than a quarter of the coke that is made. I do not think there is any difficulty in constructing a furnace to do that; and it can be done without infringing anybody's patent.

The President—I would like to ask Mr. Fullager for his experience with the furnaces used at the Cincinnati (Ohio) works.

Mr. Fullager—I have no data with me, but can state from memory that last year we operated at our West station eighty benches of sixes. The retorts are 14 in. by 22 in. by 8 ft. 3 in. We produced 7,500 cu. ft. of gas per mouthpiece each 24 hours; charging 250 pounds every four hours. The new benches, or those recently constructed, take up scant 25 per cent. of coke product. At our upper station a 4-inch slot in furnace runs along the whole length of the bench; and we also have at that station two of the McIlhenny benches. We run there with an expenditure of fuel amounting to 20.50 per cent. On an average we clinker once in eight days. At our lower station one man attends to the shaking up of 20 benches. We have had no trouble from stopped stand-pipes. The other day, at the new station, we attempted to reach a production of 10,000 cu. ft. per mouthpiece per diem, and had plenty of stopped pipes. When making 9,500 feet per retort we have had no trouble from these stoppages. I fail to understand how engineers secure such great results when working at intense heats, without encountering the stoppage drawback. Some of them claim not to know what a stopped stand-pipe is. I find tar in our main; and it is also my experience, with intense heats, when burning off heavy charges, that a great deal of lampblack is made. We might as well "speak out in meeting" and "own up" to the faults when narrating our story as to the benefits of improved furnaces. The great object should be to overcome the slight defects. At Cincinnati we are somewhat crippled, when contrasted with the conditions prevailing at other places, in the matter of obtaining the fullest measure of benefit from the use of improved furnaces. After the first furnaces were built we had to tear out their bottoms and raise them up. Our trouble began with the flood of '82; then came the flood of '83, which put out our retort house fires. The flood of '84 reached a point 6 feet higher than that of 1883. We have been changing these furnaces down below in order to run them as long as possible; and, as a consequence, they are now very shallow. We have had to put in a secondary furnace "upstairs," and that spoils the combustion chamber. Others are able to build a perfect combustion chamber, but we cannot do it. Our statement of fuel account is not computed by weight or measure. Say, in a bench of sixes, we draw and use the coke from one retort—we figure that as 20 per cent. When two retorts are similarly drawn we figure the percentage as 33. I have visited retort houses where it has been said 20 per cent. of coke was used; but in those same houses, time and again, I noted that the coke contents of two retorts were used. I submit that fuel account is nearer to 33 per cent. than it is to 20 per cent. At our upper station we take up the coke from 1½ retorts in furnace firing; at the lower station the product of 1½ retorts is absorbed. I put the latter at 33 per cent. I want neither measuring nor weighing of coke. The way I measure is to draw right from the retort into the furnace. Of course, some way out of the stopped stand-pipe trouble must be devised before we can secure the full benefits of improved furnaces. I have placed faith on outside walls to keep the stand-pipes cool. I have had the cool air blowing right on the stand-pipes, but still they have stopped up. Only one thing, in fact, is left me for trial, and that is the lime experiment. I once had a superintendent tell me he never had had a stopped pipe; but he stopped the plant every week and cleaned every pipe out thoroughly. Of course, numbers of these stoppages result from improper auguring of the pipe, and are not to be charged to the furnace.

Mr. Light—How long will your retorts last?

Mr. Fullager—I had one bench in operation for three years. The furnaces would have stood yet another setting if the Ohio river had not interfered with the scheme.

Mr. Greenough—I stated we had had no trouble with our hydraulic main with the furnaces that we have been running. I would like to qualify that to this extent: In the retorts of which I spoke it is true; but over the stack of German benches which we have recently fired we have got a main that is almost solid; as to what is the matter with it we cannot find out. Although we fired them up with moderate heats, and comparatively small charges, the tar turned into the hardest kind of pitch. They were experimenting, when I came away, to see what was the trouble. If we could not have opened the hydraulic main we must have stopped. What the reason is I do not understand. The heats of the retorts were as nothing compared with the heats of other retorts; and the quantity of coal used was not nearly as large as we could put into them. We have been experimenting, however, and when I came away they were doing better. When using regenerative furnaces we must watch our stand-pipes and main much more carefully than in the ordinary working; but I think, if the main is con-

structed large enough, and put at a proper distance from the bench and some watch kept of it, there will be no great difficulty with it.

Mr. Fullager—I wish to state one thing further. I had an accumulation of tar in the hydraulic main—it was not pitch. It was more like lampblack than anything else. That got into the main, and we could not make it run. We had to keep driving it forward; but all at once that passed away. The tar in the main is now as thin as it can well be, and that, too, with the same heats.

The President—We have a member with us who has had a great deal of experience with the generator furnace in small works. I call upon Mr. Boardman for his experience.

Mr. Boardman—I suppose that our works at Macon, Ga., are probably the smallest ones in the country where a regenerator furnace has been used. Perhaps my experience would benefit the managers of some of the smaller works; and if I can show the saving derived from the use of regenerator furnaces in such plants it may encourage the managers to put them in. There is nothing like coming to a meeting of this kind to have the conceit taken out of a man. I thought I was doing very well; but I now feel a little ashamed to give my results against those of Mr. Wood and some others. However, they are at your service. I have the McIlhenny bench on an improved plan. It was fired up in latter part of July, or first of August; and I will give you the results for September, also for fifteen days in October. In September the demand upon our works was not sufficient to call out the full strength of bench; and, therefore, I only used 250 pounds per charge in retorts—15 in. by 26 in. by 9 ft.—set in a bench of sixes. Our McIlhenny furnace has a front wall of 13 solid inches—no air space at all. The heats in bench are hardly as mild as those described by Capt. White. They are what might be called a bright orange, but are very even throughout. I do not find sufficient difference in the top and lower retorts to make any variation in the charge. The charges seem to burn out about equally well, whether in top, middle or lower retorts. In September I was called upon to furnish only 1,136,000 cubic feet. In charging 250 pounds I could not always draw at the end of four hours, but had to wait 4½ or 5 hours, on account of the holders being full. One bench of six retorts, with 250-pound charges, yielded 5.23 cubic feet per pound. The yield per retort per day, on an average, was 6,311 cubic feet. The coke used as fuel, measured as Mr. Fullager measured his—*i. e.*, counting each retort as containing one-sixth of the coke product—was 33.2 per cent. I had to clinker the bench about once a week. The amount of coke used as fuel includes that employed to fire the boilers supplying steam to run the exhauster, and also the steam taken in under the bench. I took the droppings from the furnaces, screened and picked them over, and supplied from those cinders the fuel for the boiler. During 15 days of October the increased demand for gas was such that I could run the bench pretty regularly. During that time I sent out from it 769,000 feet of gas; charged 325-pound charges, and burned the charges off in four hours. The yield per pound of coal was 4.77 cubic feet. The average yield per bench per day was 54,000 cubic feet. The average yield per retort per day was 9,107 feet. The largest output, during three days' running, was 9,666 cubic feet per retort per day. The amount of coke used as fuel in all departments was 32 per cent. I think those particulars demonstrate very clearly that, even in small works, or where there is sufficient output to run one bench with regularity, a regenerator furnace is advantageous. I have a ready sale for my coke, and save quite a good deal of it by working with a regenerator furnace. Then, also, there is a great gain in the direction of increased comfort of the men in retort house. The radiation from the bench is very slight.

Mr. Anderson—How many men do you employ?

Mr. Boardman—I have two men on each shift, or four men altogether. They do all the work. I run two furnaces of sixes.

Mr. Anderson—As Mr. McIlhenny is not present I would like Capt. White to answer for him. Mr. McIlhenny's facility for getting Kanawha coal, at much less cost than Youghiogheny, makes an inducement to use it. I would like to ask Capt. White if he knows what quality of coal is used at Washington; also what his observation was as to the effect of the heat on the furnace.

Capt. White—As I remember, Mr. McIlhenny is using a mixture of Pennsylvania and Kanawha coal—about the proportion of two-thirds to one-third. I believe Mr. McIlhenny makes it a point not to buy the soft or more friable West Virginia coals, but buys hard coal, approximating somewhat to the character of the Pennsylvania coals. In answer to the question as to the effect of the heat upon the settings, I will say that the bench I have been paying most attention to has been in operation there since last May, and I failed to note the slightest wear or tear upon the fire-brick material. It may be of interest to give you Mr. McIlhenny's description of his observation of how the regenerator principle was acting upon the furnaces employed by him a couple of years ago, and to state how that observation induced him to try the present method, which seems to be so successful. Unfortunately, as you all know, Mr. McIlhenny is crippled, and is obliged to travel about his works in a little wagon. He was sitting in his retort house—after one of his most discouraging failures with the old-style of regenerator furnace, and which plan he had decided to abandon—in front of a bench (directly opposite the port of the combustion chamber), watching the effect of the air coming from the side flues on to the top of the throat of the primary combustion chamber. He found that the air, instead of (as the theory presumed it did, and as we all presumed it did) entering with the furnace gases above and making an intimate mixture and causing rapid combustion there, it really (by reason of its having greater specific gravity than the outgoing gas) passed down through the furnace throat; and that the secondary combustion, instead of taking place above this port, was actually taking place deep in the mouth of the furnace. The idea Mr. McIlhenny received from this observation was that he must make his first fire produce its gases under some pressure, so that, on issuing from the furnace, they would enter the combustion chamber with some impetus, carry the air upward with them, and complete the combustion in the arch. His first experiment was to close the throat partially by passing fire-brick back over it, or so that the six-inch opening was reduced to two one-inch openings on each side of these fire-brick. The gases generated in the furnace were thus held back under pressure, and made to issue with some force through this narrow port. The air feeding out at right angles was carried up with the outflowing gases, and the perfect combustion he had been seeking for was obtained. Instead of having an intense white, blinding heat in the arch, a mild orange—a perfectly even heat all over the bench—was secured. No portion of the retort arch is subjected to a great heat; and under such circumstances the fire-clay material must last longer than under the old method, where we had one hot retort, one medium hot retort, and a pretty cool one. Thus you have a bench of retorts all able to do the same work, and doing it with the least possible expenditure of power. You have just enough heat to carbonize the coal without any waste. You can almost put your hand in the gases escaping from the chimneys, showing that they have been thoroughly burned, their heat extracted—in short, that you are simply passing off waste gases that are of no value. Of course other furnaces are doing this now. The furnace Mr. Vanderpool is putting in his works accomplishes the same result in the same way—although Mr. McIlhenny claims he discovered this feature in the manner I have described to you. It seems to me there is no limit to the life of the fire-brick material of arches under these circumstances.

The President—I would like to ask Col. Stedman as to his experience at Newport with his own furnace.

Col. Stedman—My experience has continued very much the same as that related at the previous meeting. We have had continuously good success with the furnace; and I do not know that I have anything to add to what I have before said on the subject. The chief point seems to be, not that we get a tremendously high heat, but that the furnaces are very easily managed and the destruction of the fire material is very slight indeed. A great many theories have appeared in the papers (particularly in the London *Journal*) about heating air and heating gases. The arguments have seemed to result in making "confusion worse confounded" about our present knowledge of mingling heated air and heated gases, and the resulting temperatures. Of course a theory can run over a very wide range; but practice narrows a theory down to comparatively small limits. It seems to me that the amount of heat necessary to carbonize coal is a matter of temperature, and when you attain the temperature necessary to pass a given degree of heat, through the thickness of the retort, it does not make much difference what the color quality of that temperature is. Whether it is a bright white, or an orange, or what not, its destructive effects must be about the same. Heat penetrates through different substances very much in proportion to the relative thicknesses and conducting power of the substances, and the difference of temperature between the two sides of the conducting substances. I think, under the circumstances, the rule holds good that if you get a very great heat on one side of a transmitting substance, with a comparatively low heat on the other side, much more heat is transmitted than would be the case if the two sides were nearly equal in temperature. We know that thickness of material governs, to a great degree, the amount of heat transmitted. As far as the quality of the heat is concerned, I should think practice would verify the theory, and prove that you require a certain intensity of temperature to produce a given effect. It is sometimes difficult to account for the widely different conditions—speaking of obstructions in hydraulic main and stand-pipes—existing when apparently working under identical temperatures and equal weight of charges. We are troubled at times with pitchy mains—then again, and with about the same average working condition, no trouble is experienced. In the past two years we have used Westmoreland coal almost exclusively—at an earlier period we used a mixture of Penn or Westmoreland and Kanawha coal—but I do not see much difference in the matter of stopped stand-pipes or pitchy mains. At times we have these troubles, but at other periods we run along with perfect freedom. Every Monday morning we place wood in the retort mouthpiece, and allow the flame to go up through the stand-pipes. The latter then give us no further trouble un-

til about the last of the week. I occupy a similar position to that held by Mr. Fullagar, in that I have never yet understood why one superintendent could, with tremendously high heats, run along without stopped stand-pipes or hydraulic main trouble, while another, working under precisely similar conditions, will have plenty of bother. I do not think position of furnace has anything to do with production of trouble in stand-pipes or hydraulic main. It is altogether a matter of heat intensity—although the effect exerted on the stand-pipes by the thick walls may (and often does) act in the nature of lessening the stoppage tendency. I notice brother Fullagar shaking his head at that; but it is a matter fairly open to argument. We have had much discussion on this stoppage question, but have never been able to agree as to the cause or remedy. I do not think we have much more trouble now—possibly no more—than we did at the times when we were running at much lower heats and getting much smaller yields. The regularity of the temperature maintained by the regenerator furnace is, of course, a great gain (when carbonizing large weights of coal in the retorts) without requiring a great increase in intensity of temperature. On the old plan we sometimes obtained 40,000 cubic feet per bench; but we had plenty of stopped stand-pipes. Now, with a larger yield than that to the bench, the stoppage account is no greater—I do not know that it is as great. This summer we have had but little trouble; in fact our hydraulic main was only opened once during the season. The stand-pipes also kept remarkably free. The stokers, after drawing the Monday morning charges, place sticks of wood at the bottom of the stand-pipes, and the flames pass right up through.

Mr. Harbison—How long does the "Monday morning" operation take up?

Mr. Stedman—The retorts are open about an hour. Sometimes, when hurried, we let the day pass by without burning out the stand-pipes in the way spoken of, and then we are apt to have more trouble with the stoppages. We find it is necessary to maintain a certain depth of fuel in order to make the regenerator furnace effective. The ordinary depth of fuel is not sufficient.

Mr. Littlehales—Can the regenerator furnace be satisfactorily applied to existing arches; or would the arches require to be rebuilt especially for the new furnaces?

Mr. Stedman—They should be rebuilt.

Mr. Littlehales—I find, in many cases, in calculating the advantages of regenerator furnaces, only the mere saving of fuel is taken into account, without setting off the interest on the increased capital outlay.

Mr. Stedman—That consideration ought to be taken into account. Rhode Islanders, they claim, very often have this experience. A cotton mill is built and machinery is put in, and I have heard it stated that, by the time the cotton mill is ready to operate with the machinery ordered, it would often repay the owners to take all that machinery out and replace it with the new and improved apparatus that has been invented in the meantime. I think, in the case of a manufacturing operation, we frequently have to sink capital—and ignore it—in order to keep up with the advance or improvement in machinery or apparatus. At least that is essentially true of cotton and woollen manufactories. They very often have to charge off a certain amount of capital. When we reduced the amount of heat passing beneath the ashpan, and reduced the volume of steam that was being evaporated in the pan, the clinker difficulty increased at once. We have it so arranged that a part only of the products of combustion may pass out under the pan. In practice we found that the whole of the waste products might very well pass under the pan.

Mr. Enfield—The way adopted by us at Columbus, Ohio, to ascertain the amount of water evaporated, was to weigh a barrel half filled with water. Into that barrel we introduced the same steam pipe that is passed under our grate bars (running at the same rate) until the water in the barrel got too hot to allow a continuance of the test. We timed that operation, and then reweighed the barrel and contents. We ascertained that we were taking up from 25 to 30 lbs. of water. In the furnace from which we made the test we do not run the waste products underneath the ashpan.

Mr. Littlehales—One point in this discussion, it seems to me, rather agrees with the point raised by Mr. Pratt in his paper read yesterday—the necessity of showing the public what we are doing. We each would be enabled more satisfactorily to know what the other was doing if the practice in this country was similar to that in vogue elsewhere—*i. e.*, if reports of the accounts of gas companies were annually made public. I find that some men beat me completely. They beat me both in yield per pound of coal and in yield per retort. I often find I am at least three centuries behind them; but yet, if I have occasion to compare balance sheets with them, I find I can hold my own every time. I find that plenty of items are left out of the consideration which are necessary to correctly determine other issues dependent upon them. For instance—in this discussion—as to the relative merits of regenerative furnaces and others. We simply get the facts as to the saving of fuel to figure upon. The cost of rebuilding has not been taken into consideration. If Mr. Pratt's suggestions were carried out—if we could see each other's balance sheets—I think some of the statements made here would be somewhat modified. I think it would be of great advantage to each of us if we could have for dissection the whole facts of each man's working.

Mr. Spice—I have been much interested in listening to this discussion, for it shows me that this question is quite as far advanced in this as it is in the old country. It has received a great amount of attention—especially from theorists, and the theorists quarrelled among themselves. But I think I may say practical men have arrived at the conclusion that the balance of feeling and judgment in England is in favor of the improved regenerative furnace—not the regenerator, because it is thought the additional profit derived by the use of the latter is more than counterbalanced by complicated arrangement of brickwork, flues, etc. It strikes me—I will be excused for making the suggestion—that your future discussions will be rendered much more valuable if you will lay down a certain rule in regard to the way in which the percentage of fuel is arrived at. Our simple way in England is this—whether the coke is measured or weighed—that is to say, whether the manager is debited with 38, or 37, or 36 bushels of coke, or 13¼ cwt., to the ton of coal (of course, I speak of the long ton, and of the long hundred weight—112 pounds and 2,240 pounds), whatever he is debited with, that fixes the percentage unaccounted for, and which is debited to the fuel account. In that way the best results that I am acquainted with are obtained. I have not entered into the subject practically at present, although I am about to do so. It is only when opportunity occurs to build a new stack that I should think of dealing with it. I shall have to extend one or two works that I am concerned in, and will not think of continuing the old-fashioned furnace, but shall adopt the regenerative system. The best example I am acquainted with is that of Mr. Valon, of Ramsgate. He sells 84 per cent. of the coke made, and uses 16 per cent. for fuel. You may have done quite as well as that here. I have not heard what the general average result is here, but Mr. Valon's showing is the best English result with which I am acquainted. I think if you would adopt that plan of computing the percentage of fuel used it would make your statements clearer. If you take the balance sheet of your company and find so many tons or chaldrons of coke have been sold, then you may debit the rest to the fuel account. When you adopt that plan of estimating we will all be on the same footing.

Mr. Starr—How many retorts does Mr. Valon operate to the bench?

Mr. Spice—I think, as a rule, his settings are eights; some of his settings are in sixes.

Mr. Starr—I have often thought that if we increased the number of retorts in a bench—say from six to twelve or twenty—we might materially reduce the amount of fuel used. Suppose we had two more rows of retorts at the upper or warmest point, would the fuel account be greatly increased when working under the regenerative principle? Under that plan of heating I believe you can work ten retorts almost as well as you could work six. Still, there is the trouble about charging the upper retorts. In a bench of eights I fail to see why we cannot place them in two rows at a good height. Our men were formerly required to stand on a bench when filling the upper retorts, but now we employ "longer" men. I should like to ask Mr. Spice (who is conversant with English practice) what is the advantage of having eight or ten retorts to a bench? Are there movable floors that may be hoisted up by machinery, and thus permit of handy charging of the upper retorts? Possibly that might be done.

Mr. Spice—It has been done in England—not in connection with this particular mode of firing, but with the old furnaces. Mr. David Mathes, who died ten years ago, tried them at King's Cross. He put up as many as twelve retorts, vertically. There was a simple floor, and a traveling wagon upon which the men stood in order to reach the upper retorts. There is, however, no occasion for going into that question for the sake of comparing the value of the regenerator furnace with the ordinary furnace. My idea is that you may take 30 per cent. as good work, on your plan, for the firing of any number of retorts—say six, or eight, or ten. Say that your fuel amounts to 30 per cent. with the ordinary furnace; then if you adopt the regenerator system, for the same number of retorts, you will find your fuel down to 16 per cent. At least, such is the result of my observation.

Mr. Starr—I want to ask Mr. Wood if he had any trouble in the stand-pipes.

Mr. Wood—With high heats and large yields we have always been troubled with stopped stand-pipes; and you must expect to have them unless you have proper appliances to obviate the difficulty. We never have had trouble with our hydraulic main, but, whether with the old furnace or with the new, we have always had stopped stand-pipes—unless we provided some way for remedying the stoppages We have succeeded in keeping the pipes clear from pitch by the introduction of water.

Mr. Lansden—Can Mr. Spice give us the yield and candle power obtained by the gentlemen to whom he referred? I claim that a statement as to fuel used forms only a partial answer to the question as to what is the best mode. The claim made here is that 16 per cent. of fuel is used. I can say that I used 5 per cent. of fuel; but that does not give us any information with regard to what that 5 per cent. of fuel does. If we have a report as to yield,

candle power, and temperature, we may then intelligently understand why but 16 per cent. of fuel is taken up.

Mr. Spice—As to candle power, I can only say that it was in no manner affected by substituting the regenerator style for the old-fashioned furnace. The quality supplied is 15¼ candles. Mr. Valon's gas is made from Newcastle coal, the ordinary yield from which, in point of candle power, ranges from 15 to 15¼ candles.

Mr. Lansden—The yield to the pound of coal is what I refer to.

Mr. Spice—We do not go by the pound of coal; the yield is 10,000 cubic feet to the ton of 2,240 pounds. I am making 10,250 cubic feet of gas from a ton of coal at the Tunbridge Wells works. That is the general figure where the work is done well.

Mr. Greenough—I would ask whether that 16 per cent. is not based upon the estimate of 36 bushels of coke per ton.

Mr. Spice—It is based upon the weight of the coke. It is so many hundredweight to the ton of coal. The coke yield is about 13¼ cwt. per ton of coal. It is 16 per cent. of the weight.

Mr. Greenough—But 16 per cent. by weight is over 20 per cent. by volume.

Capt. White—I would like to ask Mr. Wood one question. We seem to be overlooking a most vital feature of this regenerator furnace—as to the depth and body of fuel in the furnace. I think the whole success of the regenerator furnace is due to that. I want to know from Mr. Wood if he has made any experiments in varying the depth of the fuel charge.

Mr. Wood—We have not varied the depth of the fire. The depth of coke on the grate bars runs from 3½ to 3¾ feet deep; I have not varied from that. We feed the furnace from the two lower retorts, and use less than the coke made in those retorts. If we used all of the coke made in the two lower retorts, the quantity would amount to 33½ per cent. I think, by the bushel, we have employed, on an average, over 25 per cent.

Capt. White—Have you made any changes in the depth of the coke? According to this discussion the depth ranges between 2½ and 5 feet. The advocates of different depths of fuel claim the best results from the depths they have practiced. I am very much interested in this subject, and would like to get information on that point.

Mr. Wood—I use, as I said before, a depth of about 3 ft. 8 in.

Mr. Fullager—The first furnace we built was 16 in. wide, 4 ft. long, and 6 ft. 6 in. in depth. From those furnaces we have secured our best results. The coke in the furnace was always of a dull red color; but from the moment we raised them up, on account of the flood, the heats grew more intense. I think you will not consume as much coke, and that your furnace will last twice as long.

Mr. McMillin—The question of depth of furnace is an important one. We have at Columbus, Ohio, eight furnaces that are 3 ft. 9 in., and have had very good results from them. They are regenerative. We also have eight furnaces (only four of which have been used) that are 13 feet from the grate bars to the bottom of the retort. They are not regenerative. Losing that advantage of waste heat, they are still a great deal better than the 3 ft. 9 in. regenerator furnaces. I have no doubt that the furnaces themselves will last ten years; and I do not know but that they will last forever. We have used them for about a year. We have made some changes which have not been to our advantage. We had a bridge wall setting in before, but then the heat was so intense that it almost cut the retort in two. Where the flame went up and passed down over the bridge wall it was far too hot. A cast iron pipe would melt in the retort in a few minutes. In resetting them we abandoned the bridge wall and used the old setting, but have not been able to get as good results as before. The retorts that we had in use last year were 13 in. by 22 in., and 9 ft. long. In cases of emergency I have charged them with 350 pounds every four hours. I do not think it is at all a question of importance as to whose regenerator furnace you use, but that it is simply a question of heats. A high temperature will give you stopped stand-pipes, under the same conditions, whether it be one or another furnace that is in use. Your front and top walls would be the same, unless you had air chambers in one and not in the other. But, as far as the furnace itself is concerned, you will have identically the same radiation and the same hot bricks in the one (at the same temperature) that you have in the other. We do not know what it is to clinker a furnace—if what you mean by clinkering is drawing out the grate bars and cleaning the furnace all out. We never do that. We commenced by clinkering one furnace every day; having then four furnaces, this would make the furnaces run four days. We dropped down to eight days; then to three weeks; and during the last six months we ran them we never clinkered them at all. We shovel out the ashes once in 24 hours. The coke hangs loosely above until the ashes are shoveled out, and then, by striking it with the shovel, it drops down. We run steam in those furnaces under the grate bars. With the others, which are only 3 ft. 9 in., we evaporate water with the waste gases; but we run a little steam in there also. The question of soot in the stand-pipes seems to be the result of secondary decomposition, and will not always be the result of high heats; still, high heats would certainly be more apt to produce it than low heats. At certain heats, if a compound or molecule of 4, 6, or 10 atoms of hydrogen, in combination with carbon, is broken up, the hydrogen is set free, and it may give you poor gas and soot, but it helps you with your yield. Our stand-pipes were troublesome at one time when we were trying the retorts and furnaces for the purpose of seeing how much we could make. We got them so thoroughly stopped up that we had to take them down and clean them out. We had to build fires on the floor and burn them out. In two instances, after two men had worked on the stand-pipes for two days, we had to throw them away. I came to the conclusion that that way of working would not pay. We get, I think, just as much from the mouthpiece as in the other regenerator furnace. These furnaces are about the same as Mr. Fullager's. I run smaller retorts than most of you do. We do not get any such results as are reported here. We think it does not pay the consumer; nor does it pay to destroy the retorts. I think, with those furnaces alone, we could run along with the Youghiogheny coal at 8,500 cubic feet per mouthpiece, and have no trouble, and at the end of the year have better results. We use coal, however, that might be charged in almost any quantity, and the heats run up to almost any temperature, and yet not stop the stand-pipes. I read of a coal yesterday which contains a large percentage of water; and it is said that with it gas works very seldom have any stopped stand-pipes. But they get 12 to 15 per cent. of water out of the coal.

Mr. Lindsley—With regard to this matter of stopped stand-pipes, I may say that, in our works, we have two retort houses. In the old house the stand-pipes are close to the face of bench, but in the new one the pipes are quite a distance from the walls. In the new house the heats have always been kept very high; but I think I can count on my fingers the stopped stand-pipes that we have had during the time the house has been in operation. In the other or older house stoppages are of almost incessant occurrence.

Mr. Anderson—The remarks of Mr. Boardman lead us to consider the adaptability of these furnaces to small works. Mr. Littlehales raises the question as to the cost. Mr. Boardman operates an improved furnace in a works where one bench of sixes supplies his summer output. Has he more than one bench going in the winter time?

Mr. Boardman—In the winter time I operate two.

Mr. Anderson—I am putting in an improved furnace in a works where we run only one bench of fives during the winter. Cost has a great deal to do in changing to the regenerator furnace. A great many imagine that, to have such a furnace, it is necessary to pull down the works and build up anew. In Mr. McMillin's works, at Columbus, Ohio, furnaces were built under the old arches that were put in ten or twelve years ago. In any works furnaces can be set up without removing any of the castings, except those that are usually removed in changing the benches. The furnaces can be set in with hardly any additional cost, and they will run longer than the old furnaces. You obtain higher heats; generate more gas; you have more uniform heat; you do less damage to the benches; and you use less fuel. I think Mr. Littlehales will find, on trial, he could put those furnaces in his works at very little additional cost, and without a great deal of annoyance.

Mr. Lansden—I think we should hear from our President on this subject. He has been using the same style of regenerator furnace that we have been speaking of.

The President—The discussion has already been so extended that our time has become quite limited. I will state what we have done, in a few words. We have not as yet had experience with the generator and regenerative furnace. We have been investigating so as to ascertain what was the best system in use in this country, and on the other side, most adaptable to our works, and have finally concluded to adopt the Stedman furnace and the Klönne furnace. We put one furnace alongside the other. It is not necessary to explain the construction of the Stedman-Stanley furnace, as you have heard all about it this morning. Investigations made on the other side convinced us that the furnace we ought to adopt, in addition to the Stedman-Stanley, was the Klönne. It has been used a number of years, and is used largely in Europe. It is adopted and employed in a great many works there. It is used in Holland, and in the northern part of Germany; in France, largely; in England, in Spain and in Italy. This furnace differs very decidedly from some of the other regenerator systems. In the first place the generator is very large—so large that it is capable of taking a very great amount of coke. The furnace extends the entire length of the benches—the bench being 9 feet 6 inches long. It has a very large grate area—the grate at the bottom being over four feet wide. This large grate area permits the furnace to be worked under a very low draft. I think that a quarter of an inch is a sufficient draft at the bottom of the grate to carry in the primary and secondary air supplies, and then carry the products of combustion down through the recuperating system. It has been found, where the furnace was contracted, and where the generator opens directly into the setting of the retorts, that the combustion was very intense where the secondary air supply came in contact with the carbonic oxide and the gases produced in the generator. The result has been that in almost every case where that sort of furnace has

been adopted there has been great trouble from the melting of the fire bricks. It has been impossible to get any material that would stand the intense temperature resulting from the gases coming in contact with the secondary air supply in that short length of furnace. In other words, it was like a blowpipe, and the heat was intensified in the short length of furnace. In the Klönne system the gases are kept under pressure in the generator, and then issue through ports in the generator arch, and then are regulated as Mr. McIlhenny regulates them in his furnace—by means of dampers placed over the ports which deliver the gases into the settings—so that the secondary air supply cannot go down into the generator. The generator is always under pressure, and the gases cannot come in contact with the secondary air supply except at the right point. The combustion takes place among the retorts, and the products of combustion are taken down through a very simple system of recuperation, and one which presents a large area to the incoming primary and secondary air supplies. After investigating this furnace we made a contract with Mr. Klönne upon a guaranty that we should have left from the coal carbonized 1,200 pounds—to the ton—of salable coke, when weighed hot. When I speak of salable coke I mean the large coke. The breeze and fine stuff from the retort house coke is to form a part of the fuel. If we were to take the bulk of the coke as it comes from the retort, and include in it the breeze, of course we would have a greater weight of salable coke; but the guaranty is that we are to have 1,200 pounds of salable coke to the ton of coal. The benches are set with nine retorts. The retorts are 9 feet 4 inches long on the inside, and 15 by 26, in section, inside. We are to produce at least 10,000 feet per retort in 24 hours. We are to have no stoppages in the stand-pipes, bridge-pipes, or hydraulic main, or not any more in Klönne's system than we would have under the old system or with the old furnaces. These furnaces have been erected during the last summer, together with the Stedman-Stanley furnace, and we have just commenced to fire them up. I think that a year hence I will be able to tell you more about them.

On motion of Captain White, the thanks of the Association were tendered to Mr. Wood for his paper.

[To be continued.]

An Abstract of the Tests of the Gas Lamps Exhibited at the "Novelties" Exhibition.

By H. C. Adams.

In presenting to the readers of the Journal an abstract of the report of the judges who examined and tested the gas burners shown at the "Novelties" Exhibition recently held in Philadelphia under the auspices of the Franklin Institute, we feel confident that it will be read with satisfaction and surprise. It is worthy of note that while the results obtained by the examining committee at the recent Electrical Exhibition, from the arc and incandescent electric lights, summaries of which have appeared in the Journal, fell in most cases far short of, and in some instances almost absurdly below, the efficiencies claimed for those systems—yet we find, in the results obtained from the gas burners, efficiencies that not only equal but surpass the claims of the manufacturers.

In the short sketches that we gave of the methods pursued by the examiners of the electric lights at the Electrical Exhibition will be found a fit estimate of the care and accuracy with which the committee of the Franklin Institute discharged their duties; and it is only necessary to say that the same conscientious and painstaking work characterized the examination of the gas lights.

The report proceeds cumulatively from the light of the lowest to that of the highest efficiency; and in that we shall follow it. In these tests the city gas was used—its candle power being carefully tested before each examination.

I.—The Wasserman Regenerative Gas Lamp.

Tests made Oct. 26th, 1885; city gas at time of test gave 16.20 candles.

Test No. 1.—Gas burned per hour	10.50	feet.
Candle power	35.60	"
Candles developed per foot of gas	3.39	"
Test No. 2.—Gas burned per hour	9.00	feet.
Candle power	38.95	"
Candles per foot of gas	4.32	"

Or an average of 3.85 candles per foot.

The committee says that in view of the fact that such a comparatively simple burner shows the above efficiency, they award to Mr. Wasserman a bronze medal with the diploma of the Institute.

II.—The Albo-Carbon Gas Lamp.

The tests of this lamp were made with a small fixture having only one burner, because the large clusters, so generally used, could not be tested without extensive alterations in the photometric arrangements.

Tests made Nov. 2d, 1885; city gas at time of test, 17.25 candles.

Test No. 1.—Gas burned per hour	4.80	feet.
Candle power	29.70	"
Candles per foot of gas	6.18	"
Test No. 2.—Gas burned per hour	4.95	feet.
Candle power	41.10	"
Candles per foot of gas	8.30	"

Or an average of 7.24 candles per foot.

Naphthaline consumed per thousand feet of gas, 2.88 lbs.; cost of same, at 12 cents per pound, for 1,000 feet of gas, 34.5 cents; cost of city gas, $1.60 per 1,000 feet—light, 17.25 candles; cost of carburetted gas, $1.94½ per 1,000 feet—light, 36.25 candles. In view of which Messrs. Kitson & Co. were awarded a bronze medal and the diploma of the Institute.

III.—The Siemens Regenerative Gas Lamp.

It is but just to say that in other tests made elsewhere the Siemens lamp has shown a much higher efficiency than it is credited with below; but we can give no exact explanation of the difference. The Franklin Institute tests were made on a bar photometer, with a length of 280 inches between the lamp and the standard, which latter was a Sugg Argand rated to pass five feet of gas per hour. The measurements were all made in horizontal plane.

Tests made Nov. 3, 1885; city gas at time of test equal to 17.71 candles.

Test No. 1.—Gas burned per hour	51.18	feet.
Candle power	364.65	"
Candles per foot of gas	7.12	"
Test No. 2.—Gas burned per hour	51.18	feet.
Candle power	463.11	"
Candles per foot of gas	9.04	"
Test No. 3.—Gas burned per hour	48.00	feet.
Candle power	396.52	"
Candles per foot	8.26	"

Or, an average of 8.14 candles per foot. For that exhibition the Siemens-Lungren Company received the silver medal and the diploma of the Franklin Institute.

IV.—The Lungren Inverted Regenerative Gas Lamp.

The flame of this lamp, being entirely below the lamp, the horizontal rays of light would not represent its actual efficiency in use; and therefore the examiners found it necessary to construct a special photometer for angular measurements.

Horizontal measurements were made upon the bar photometer used in testing the Siemens lamp, and resulted as follows:

Horizontal measurements made October 31, 1885; city gas at time of test equal to 17.69 candles.

Test No. 1.—Gas burned per hour	16.44	feet.
Candle power	124.71	"
Candles per foot of gas	7.58	"
Test No. 2.—Gas burned per hour	17.85	feet.
Candle power	155.84	"
Candles per foot of gas	8.73	"
Test No. 3.—Gas burned per hour	17.25	feet.
Candle power	157.62	"
Candles per foot of gas	9.13	"

Or an average of 8.48 candles per foot in the horizontal.

Measurements were then made, after proper photometrical adjustments, at 45°, and in the vertical—*i. e.*, at 45° below the horizontal plane of the lamp, and at the perpendicular beneath the light.

Forty-five degree angle tests, made Nov. 5, 1885; city gas at time of test equal to 18.60 candles.

Test No. 1.—Gas burned per hour	16.20	feet.
Candle power	197.16	"
Candles per foot of gas	12.17	"
Test No. 2.—Gas burned per hour	16.65	feet.
Candle power	231.78	"
Candles per foot of gas	13.92	"
Test No. 3.—Gas burned per hour	17.20	feet.
Candle power	230.64	"
Candles per foot of gas	13.40	"

Or an average of 13.16 candles per foot.

Vertical test made Nov. 5, 1885; city gas at time of test equal to 18.60 candles.

Test No. 1.—Gas burned per hour	16.00	feet.
Candle power	223.86	"
Candles per foot of gas	13.99	"

Only one test was made in the vertical; so we have, as an average of the 45° and vertical tests, an efficiency of 13.57 candles per foot—an unprecedented and surprising development, which is the more peculiar as obtained in such a small lamp.

The judges speak unqualifiedly of the Lungren lamp, and pronounce the 'quality of the light as unsurpassed for brilliance, steadiness, and color." We cannot do better than to quote the conclusion of their report on the Siemens-Lungren exhibit: "In view of the advantages of this lamp (Lungren), and of its remarkable efficiency, as shown in these tests, we would recommend the award of the silver medal, with the diploma of the Institute, to this lamp.

"Furthermore, in view of the fact that the Siemens-Lungren Company have established the manufacture of the Siemens-Lungren lamps in a way to supply the demand in all the required sizes thereof, and have thereby added a new and valuable industry to those already established in our city, we would recommend the award of the Elliott Cresson Gold Medal."

The Elliott Cresson medal was established by a trust fund placed in the hands of the Franklin Institute, in 1848, by Mr. Elliott Cresson, of Philadelphia, Pa., and is awarded only to inventions or improvements of most distinguished merit. This is attested by the fact that the medal has been awarded only five times since 1848.

We believe that these gas light tests are the most gratifying and encouraging developments that have ever been produced. They should certainly give renewed energy to those investigators and inventors who are discovering the "possibilities" of gas as an illuminant; and they come most opportunely at this time, when the incandescent electric lamps are being pushed forward so prominently as would-be competitors with gas lighting. Every improvement in gas lamps is, as we have before stated, equivalent to a reduction in the price of gas; and if the manufacturers of lamps and of gas unite in efforts to perfect their several systems, experience surely seems to justify the belief that no other medium of illumination will be able to approach gas light in efficiency or economy.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

LONDON, Dec. 10, 1885.

The Proposed Sulphate Maker's Association—Mr. Henry Woodall goes to Australia—The Otto Gas Engine Patents—The South Metropolitan Gas Company Reduce Their Price—What shall We do with the Tar?

The preliminary meeting of the proposed "Sulphate of Ammonia Producers' Association," alluded to in the latter portion of last month's letter, was held on the 13th ult., at Cannon Street Hotel, London. The attendance was large, and thoroughly representative, the chair being taken by Alderman Moscrop, the Chairman of the Gas Committee who manage the affairs of the Bolton Corporation Gas Works. Bolton is a large manufacturing town in Lancashire, and the undertaking is of such extent as to entitle Alderman Moscrop to an important position in the gas world, apart from the fact that he is well known as being interested in all matters relating to the improvement of the gas industry. So the meeting was fortunate in its chairman. The convener of the meeting, Mr. Geo. E. Davis, having stated his views, the assembly was addressed by other gentlemen present; and it was unanimously decided that an association should be formed for the purpose of watching over the interests of its members, and that the annual subscription should be one guinea for makers turning out less than 50 tons of sulphate per annum, and two guineas for those producing larger quantities. The usual steps for the preparation of rules, the election of a committee of management, etc., were taken, and the whole thing has now made a satisfactory start.

The removal of Mr. Henry Woodall, who has for some years occupied the office of Engineer and Manager of the Leeds Corporation Gas Works, to Australia—he having accepted a similar post in connection with the Suburban Gas Company of Melbourne—is a matter of something more than local interest; not merely because that gentleman stands next in order for election as president of the Gas Institute, but rather because he is the representative of a particular line of policy in gas making. How far his views have proved advantageous in practice will be evident at a glance at the state of affairs at Leeds in the year 1875, when he first took office, and the condition in which they now stand. Gas of sixteen-candle power was at that time supplied at a price of 3s. 9d. per 1,000 cu. ft.; now the gas is sold at less than one half, or 1s. 10d. per 1,000 cu. ft. Besides the quality has been raised to 20 candles, or to the extent of 20 per cent., and the public lamps are supplied at the absurdly low price of 6d. per 1,000 cu. ft. Taking these points into consideration, the price paid by the gas consumer of to-day is not much more than one-third that paid ten years ago. Although they have been supplied with 80 per cent. more gas, they have actually paid considerably less money for it; the actual figures for gas and meter rent during the year 1875–6 being £166,709, while those for the last year—1884–5—were £144,681, or more than £22,000 less. Results such as these may well be pointed to, with excusable pride, by the gas engineer who has been the means of securing them; for in the absence of careful repairing and renewing and carrying out the necessary enlargements of plant—which will be seen, by the increased output of gas, to have been very extensive during the period in question—on the cheapest possible plan consistent with efficiency, they would not have been attained. Thanks to the good management of Mr. Woodall, and to his knowledge of financial as well as engineering matters, the Leeds Corporation have been able to boast for some years past of selling the cheapest gas in the United Kingdom. But matters have not been allowed to rest here. Mr. Woodall had lately brought before the notice of his committee a scheme for supplying gas during the daytime, for purposes other than lighting, at even a much lesser rate than the above; and he was confident that, if carried out, it would result in general advantage to the whole concern. So far as I understand Mr. Woodall's views he considered that the result of offering gas for day consumption at the lowest possible rate—the present cost price—would be the securing of a large increase in consumption for gas engines, heating and various technical purposes. This increase might come on gradually, concurrently with reductions in price, in the course of years; but the only way of obtaining it at once was to tempt the consumers by a considerable reduction of price. The increased demand could be met by apparatus erected according to the most approved modern plans, at a cost much lower than that of existing plant; and this, with other economies that might follow the increase of business, and which are attendant upon the increase of consumption, *per consumer*, as well as in the aggregate, would gradually reduce the first cost all round and lead to a general leveling down of prices. Mr. Woodall is going to work for a newly-established company at Melbourne, and apparently in the face of opposition from existing undertakings; so it is evident that the directors have done well in securing his services; and we in England shall watch with much interest the results that will grow up under that marked gas engineering ability which has done so much for the gas consumers of Leeds.

A great lawsuit is at present in progress in the Chancery division of the High Court of Justice, the validity of the well-known Otto gas engine being in question. Dr. Otto, the proprietor of these patents, has raised an action against one Robert Steel for infringement of patent, and is represented by an array of no less than five lawyers. Mr. Steel has only two; so perhaps he believes in the homely saying, "Too many cooks spoil the broth." I do not know what benefit comes out of these patent actions to the parties themselves; but, speaking as a gas engineer, I say it is very kind of them to go to law, and to get the best experts obtainable to come forward and describe the principal features of their inventions. The evidence in previous law cases, on various matters relating to the gas industry, constitute some of the most valuable sources of information obtainable, and is read long after the points at issue have been forgotten. Dr. Otto has already contributed in this regard, and, according to the extent to which this present case has extended, we shall be furnished with a complete treatise on the gas engine by the full report. Otherwise I do not know that he is entitled to much sympathy, for there is no doubt but that the high price at which his engines are vended to the general public has been such as to hinder the adoption of this form of motor; so he has already, during the nine years in which his patent has been running, realized a good fortune from it; and if he is unsuccessful in the present action the gas industry will profit by it, as with open competition there would soon be much cheaper gas engines in the market. And gas engines, at a price only sufficient to yield a reasonable profit on their manufacture, would be used to a much greater extent than they are at present.

The witnesses examined in this case included Sir Frederick Bramwell, Mr. C. D. Abel, Mr. John Imray, Dr. Hopkinson, and others. The speech of Mr. Moulton, in opening the case for the defence, is worthy of note. This gentleman is remarkable as having a clear grasp of scientific subjects, which was especially shown by his conduct in connection with the Parliamentary Inquiry relative to the Electric Lighting Act, 1882, in which he represented several promoters of electric light companies; and he is eminently qualified for undertaking a question such as that which represents the interests of Mr. Steel.

The South Metropolitan Gas Company announce that on the 1st of January their price for gas will be reduced to 2s. 6d. (60 cents) per 1,000 cubic feet. The present price is 2s. 8d. Under ordinary circumstances there would be nothing of special remark in this announcement, for it is well known that this Company has adopted the policy of cheap gas; but circumstances do not at present point in the direction of reductions, and many companies are talking about increase of price. Nor do they appear more favorable, in the case of the South Metropolitan Company, than in that of others. The Company have just incurred considerable expenditure of capital in building new works at Greenwich. They have recently amalgamated with some small outlying undertakings, which can scarcely prove immediately profitable. Added to this, they are subjected to the common misfortune due

to the fall in the price of liquor, which seems to get worse and worse, and which affects the selling price of gas to the extent of 3d. or 4d. per 1,000 cubic feet. An undertaking that can talk of a reduction of price in the face of such adverse circumstances must indeed be in a prosperous condition, and its next half-year's balance sheet will be an interesting document. Their neighbors, the Gas Light and Coke Company, will not thank them for this reduction, as they are bound to supply the public lighting at the lowest price charged in London; so the move made by the South Metropolitan Gas Company means a compulsory reduction in the charge for gas consumed by the public lamps throughout the large district supplied by the Gas Light and Coke Company,

What shall we do with our tar? is a question that is now heard from many out of the way gas works where, on account of the present low market value, the prices offered for it are so trifling as scarcely to cover the cost of transport to the nearest railway depot. In this respect we seem to have gone back 30 or 40 years, and it seems likely that the days when tar was allowed to soak away into the earth, and when the tar well was *pro bono publico*, are likely to come again. To show that this is no exaggerated picture, I may mention that the best offer which a neighbor of mine could secure was 5s. per ton delivered at the railway, and of which the cost of delivery would absorb about 3s.—leaving him only a net receipt of 2s. per ton. The only available method seems to be—since the products contained in it, or obtainable from it, are worthless—to turn its heat producing power to account and use it as a fuel. Some success has lately been achieved in the way of using liquid fuels for boilers—notably creosote oil, which for some time has been a drug upon the market, owing largely, it is said, to the use of iron sleepers, as a substitute for wooden ones soaked in creosote, on railroad tracks. An enthusiastic friend of mine has offered to run an express locomotive with creosote as a fuel at a cost of about one-tenth of a penny per mile traveled. Several experiments were tried in the way of burning tar as fuel some 30 or 40 years ago, but they were abandoned when the price of tar increased. There are certain difficulties inherent to the use of tar in the retort house, but I never heard that they were insurmountable, and believe that "tar fuel" has been used with fairly satisfactory results in many instances. Another outlet for tar at cheap prices may be looked for in the increased use of tar asphalt for sidewalks, garden paths, etc.

This closes my budget for the year 1885. On the whole, I have had the pleasure of reporting a satisfactory state of affairs as regards the gas industry. Let us hope that tney will not, at any rate, be worse during the year that is now drawing on; if they should be so, either here or in America, it certainly will not be due to lack of interest in their duties on the part of gas works managers. Having some opportunities of insight into various branches of technical industry, I do not know of one in which the members exhibit a greater degree of zeal or desire to advance than that which exists amongst gas engineers, or one in which the special literary representative organs are better got up or better supported. In conclusion, let me express a sincere wish that the AMERICAN GAS LIGHT JOURNAL and its numerous subscribers may enjoy every happiness, and continue to prosper in every way, during the year 1886.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

SUSTAINING THE VALIDITY OF THE SPRINGER PATENTS.—The National Gas Light and Fuel Company, owners of the Springer patents and process for manufacturing water gas, recently brought suit against the managers of the Decatur (Ills.) Gas Light and Coke Company, the complainant alleging that defendant had infringed upon the Fuel company's exclusive right to vend a certain form of apparatus. It appears that defendant, in response to solicitations made by sales agents representing the Lowe patents and system, agreed to purchase and employ a Lowe plant, the latter having a combustion and firing chamber *in one structure*. As Springer always claimed priority of invention for this feature, the National Company decided to make a test case out of the Decatur proceeding. The suit was argued before U. S. Circuit Court for Central Illinois, and on Nov. 23d a decision sustaining validity of the Springer generator patents was handed down. The Court ordered an injunction to issue against the Decatur company restraining it from further unlawful employment of the Springer apparatus.

A BELIEVER IN THE IMPORTANCE AND VALUE OF NATURAL GAS.—Mr. J. M. Critchlow—and he is a wideawake gas man—is a firm believer in the fact that natural gas "has come to stay;" and he is equally convinced that the natural product will encroach upon the field of domestic and public lighting now held by the purveyor of the manufactured product. Certainly, Mr. Critchlow is well qualified to hold such views, as his letter to JOURNAL, under date of Sept. 16th, amply shows. While not willing to agree entirely with the gentleman as to the future prospects of the natural gas agent in the matter of its completely successful application to domestic lighting, we are bound to put ourselves on record as believing that gas managers operating in the great natural gas districts will find it good policy to investigate the subject with all possible care. The following letter from Mr. Critchlow explains itself:

"BEAVER FALLS, PA., Dec. 15, 1885.

"To the Editor AMERICAN GAS LIGHT JOURNAL:—Having been unable to attend the Cincinnati sessions of the American Gas Light Association (in fact I am not a member of that body), I have received both pleasure and profit from reading the report of the proceedings as they appear in your columns. I was particularly interested in the paper contributed by Mr. Denniston on the subject of 'Natural Gas,' as also in the discussion that followed it. Before writing further, let me say I am neither seeking a cheap advertisement for my process, nor am I singing the praises of the Beaver Falls Gas Company. I have, in large part, disposed of my ownership in the one to Mr. Geo. Westinghouse, of Pittsburgh, while I have recently resigned the position of Superintendent to the other. Reverting to the Cincinnati meeting. It struck me as rather singular that our Pittsburgh engineers should be so thoroughly convinced that there is nothing to fear from natural gas as an illuminant; and particularly so in view of the fact that a body of 12,000 people, resident within 30 miles of Pittsburgh, had, for several months, been extolling as superior to water gas—its predecessor—a gas manufactured from the natural product, enriched with benzine. To give the proportions: Natural gas 86 per cent.; benzine, 14 per cent. Candle power of the gas would average 19; and the product possessed the requisite 'stiffness' or 'body' enjoyed by coal gas. I tully concur with Mr. McMillin that, because Pittsburgh has failed in this matter, others will not succeed, or that they have not already done so. It is a subject that gas companies located in 'gas territory' cannot afford to slight. The Beaver Falls Company, with a daily output not exceeding 45,000 cubic feet, pays ten cents per 1,000 cubic feet for the 'crude natural,' and effects a saving of from $80 to $100 per month over what gas manufactured under the 'water patents' formerly cost it.

"Yours truly, J. M. CRITCHLOW."

We may add here that Mr. Critchlow has taken a position as Superintendent with the Bridgewater Gas Company—a company engaged in the supply of natural gas on a large scale. May he meet with every possible success in his "new departure."

WHAT KIND OF GAS BURNER DO THEY USE IN ATCHISON?—The Western *Manufacturer*, and a readable paper it is, gravely publishes the following: "There is a war between two electric light companies at Atchison, Kansas. One company proposes to put in an incandescent plant during the present winter, with a capacity of 2,000 lights. The lights will cost 1½ cents an hour when in use; the cost of an ordinary gas burner is 3 cents an hour." Hence we are tempted to ask the size of the "ordinary" gas burner employed at Atchison.

FIRE IN A RETORT HOUSE.—Of course, there is nothing strange about fire being seen in a retort house; but the plant of the West Brighton (Coney Island) gas works was visited on the morning of December 16th by a "fire" not of the "ordinary" sort. One of the retorts—an oil gas process is in use at that place—burst open, and the flames communicated to the woodwork of roof, sash, etc. Before the fire had been conquered about $800 worth of damage occurred.

CHEAPER GAS AT WASHINGTON, PA.—Mr. Jno. C. Hastings, Secretary of the Washington Gas Company, writes that the following schedule went into effect on date of December 1st, 1885:

To consumers using 1,000 cu. ft. and under, per month	.....	$1.50 per M.	
" " from 1,000 to 2,500 cu. ft. "	.....	1.30 "	
" " " 2,500 to 10,000 " "	.....	1.20 "	
" " over 10,000 " "	.....	1.00 "	

The new schedule operates only in cases where accounts are settled on or before the 10th day from time of presentation. Those are pretty low figures.

THE KELLER COKE CRUSHER.—Mr. C. M. Keller, Secretary and Superintendent of the Columbus (Ind.) Gas Light and Coke Company, has had such unqualified success with that adjustable coke crusher of his—devised by him in time of need to free the Columbus yard from its huge coke pile—that he now intends to place the same on the market. The Keller coke crusher is built over a solid and strong cast iron bed plate, placed flat on the wooden frame. The cog wheels are of 3½ inches face, with a shroud on one side, which decreases the liability to tooth breakage. The rolls are cast cylinders—slats, etc., being cast on them, thus making one solid piece. That plan, of course, does away with annoyance occasioned by the fracturing of bars and slats. The flywheel weighs 300 pounds, and an 18-inch pulley carries a 6-inch face for belt. The crusher, without wooden frame or screen, weighs 1,400 pounds. One of its most valuable features is that it can be adjusted, in almost a minute's time, to crush to any desired size.

INCREASING ITS CAPITAL STOCK.—The Marion (Ohio) Gas Light Com-

pany's capital stock was recently increased to $50,000. Former capitalization figure, $25,000.

Gas Matters at Atlanta, Ga.—Another phase in the Atlanta situation has been developed. This time "Agent" W. P. Elliott announces that the price for gas delivered by the Gate City Gas Light Company, from date of January 1st, 1886, will be rated at the figure of fifty cents per thousand cubic feet net, until further notice. The last part of the announcement ought to strike clearly upon the minds of Atlanta's gas consumers; and it will be a very dull one of them indeed who fails to understand that he or she will be caught in the net of increased tax rates for gas if proper support is not accorded to the old Atlanta Company. If the opposition "fishers" could only "fix matters" with Mr. Helme, how quickly "further notice" would be given the people of Atlanta that "net rates" would be increased to $2 or $2 50 per thousand. Both companies have been selling at $1 per thousand, since the "war" commenced; and, as a result, the old company's output has been increased by 50 per cent. during its last fiscal year. To meet the new business the managers have put in a set of 15′ × 15′ purifiers; also a new holder with a calculated capacity of 400,000 cubic feet. As soon as the weather conditions permit a trunk main from works to opposite side of town will be put down. This main will equalize the pressure conditions—the same having been rather unequal of late, in consequence of the greatly increased demand made upon the company. The managers of the old corporation do not intend to meet the "cut" instituted by the Gate City schemers, but will pursue their former tactics, and trust entirely to the common sense of the gas consumers for support. The controlling spirit of the old company, Mr. Wm. Helme, admits that, with gas at $1 per thousand, some money has been made. This will be understood when it is said that the stockholders have been paid a dividend return right along, and no debt of any sort has been incurred. Bro. Helme is plentifully endowed with the right kind of business pugnacity, and his straightforward style of acting has convinced the Atlanta consumer that "Helme's promise is a sound guarantee."

An Electric Company for Colorado Springs, Col.—Mr. N. G. Hock, Supt. of the Colorado Springs Gas Light Company, writes us that articles incorporating the Colorado Springs Electric and Illuminating Company were recently filed. The projectors are Messrs. Orlando Metcalf, Irving Howbert, and W. P. Beach. Capital stock of company is placed at $50,000. It is understood that the new corporation will attempt to secure the public lighting of Colorado Springs; but if the authorities are wise they will have none of it.

Explosion at the Kansas City (Mo.) Gas Works.—Supt. Clarke, of the Kansas City works, has had his hands full of late. First of all was the unreasonable demand made by some of the employes which culminated in a "strike." When this difficulty had been surmounted—through the discharge of the malcontents, and the filling of their places by new men—everything was going along nicely, and the dark days of the winter season kept the Kansas City gas men "up to their eyes in business." But quiet did not last long, since the telegraph wires flashed the news eastward that the works of the Kansas City company were wrecked by an explosion which occurred shortly after midnight of Dec. 9th. The explosion, according to our advices, occurred in the purifying room, and was most disastrous in its effects. The engine and meter rooms were thrown down, and the contained apparatus entirely destroyed. Of course, the city was plunged in darkness, and much inconvenience resulted—in fact the Kansas City folks have thoroughly learned what an important adjunct to their comfort and safety was contained within the walls of the local gas plant. Opinions vary as to the cause of the disaster—some contending that the strikers managed to blow the purifiers up by a judicious distribution and application of dynamite, while others argue that careless siphoning of the seals to boxes caused the wrecking. We shall more than likely be enabled in due time to place the real facts before our readers. On the morning of the 11th the Kerr-Murray Manufacturing Company, of Fort Wayne, Ind., were instructed by wire to construct duplicate boxes to take the place of those destroyed. The foundry folks agreed to work night and day upon the order, and it was expected that two of the boxes would be ready and in use at the Kansas City plant by December 24th.—[Gas was supplied on the day named.]

The Little Falls (N. Y.) Gas Company.—In our "items" for Dec. 2d we noted that Mr. I. S. Elkins had purchased a controlling interest in the Little Falls Gas Company, and seemed disposed to part with the property. Capt. W. H. White, of this city, has relieved Mr. Elkins of further ownership in the works, and the former gentleman is now in control of the Little Falls gas supply.

Cheaper Gas for Vincennes, Ind.—Mr. Geo. G. Ramsdell, Secretary and Treasurer of the Vincennes Gas Light Company, is once more to the front, as, on date of Dec. 17th, he was authorized to announce that from and after January 1st the following schedule would prevail—monthly quantities being figured on:

On bills under 2,000 cu. ft.	.....	$2.00 per 1,000
" of 2,000 and under 10,000 cu. ft.	..	1.90 "
" " 10,000 " 20,000 "	..	1.80 "
" " 20,000 and over	.....	1.70 "

The Vincennes Company commenced operations in 1875, with gas at $4 per 1,000—a pretty stiff meter rent was also charged. Before the year was over the price was brought down to $3 per thousand, and the meter rent tax was abandoned. In 1876 selling prices were decreased to $2.50; and with each succeeding year concession to consumers has been the rule, so that, with a gas fully 25 per cent. higher in illuminating power than that sent out in '75, the user of smallest quantity obtains his light at one-half the figure originally charged. The gas company of Vincennes is essentially a "home institution," as every share of its stock is owned by residents of that city; and by way of closing this brief notice of the Vincennes reduction, we may add the truth that "Ramsdell is the right man in the right place."

Notes from the West.—We have been fortunate in securing the services of a clever writer who has agreed from time to time to keep us "posted" as to what is going on in western gas circles. His first "budget" came to hand at rather a late day; and in order to make room for it we have been obliged to publish same in connection with our "item" columns. It will be noted, from the date line and signature, that our correspondent, at least for the present, desires to remain strictly *incog.*

"* * * Dec. 23, 1885.

To the Editor American Gas Light Journal:—Few men, except those intimately conversant with the gas business, ever realize the hazardous nature of gas investments. The public press, in its warfare on behalf of the 'dear public,' disdains to recognize any such feature. When clamoring over some imaginary wrong to be righted the press contents itself in its effort to be fair (?) with adding together the cost of coal and lime—sometimes allowing a fraction for labor—and deducting this from the gross selling price to show the enormity of the dividends each company is declaring. A mild suggestion from the vendor of gas, to the effect that his stockholders are entitled to a liberal dividend, in view of the hazardous nature of the investment, receives the utmost measure of derision; but yet the Kansas City (Mo.) Gas Company—for years a well managed gas corporation, and recently in an apparently unusually prosperous condition—has its works almost completely destroyed in a single night, and the anticipated profits for a long period of time forever wiped out. True to its usual system of fair (?) dealing the press reports of this calamity are wonderfully meager; and in one instance I noticed a humorous comment published upon the length of time necessary to make up the deficit! I am sure the fraternity sympathises with this company, and with its efficient head, Mr. Harry Clarke, in their trouble; and the announcement made by Mr. Payne, President of the company, that they would be ready to supply gas to consumers by Christmas eve., gives but a faint idea of the immense labor which has been accomplished in so brief a space of time. I believe it is still a mooted question whether or not the explosion was the work of disgruntled employes.

"The sudden death of Major Paul Hendricks, for a great many years Secretary to the Madison (Ind.) Gas Light Company, has cast a gloom over all those of the fraternity who had the pleasure of his acquaintance. His demise occurred on the morning of Dec. 17—he dropped dead while conversing with Mr. H. B. Foster (President of the Madison Company), who is confined to his home by illness. The similarity of his death to that of his uncle—Vice-President T. A. Hendricks—such a short time before, was peculiarly startling. Mr. Hendricks, who was in his 52d year, was a general favorite. He was private secretary to ex-Postmaster-General Gresham, and became most popular in the department (also in society circles) during his stay in Washington. He was prominent in the Grand Army ranks, and a valued member of other societies.

"The St. Louis (Mo.) gas war is as yet in an unsettled condition, but is not so strongly impregnated with the odors of water gas as was the case a week ago. At the present writing the old companies are slowly but surely gaining ground. The water gas bill, so unceremoniously sprung on the House of Delegates, was passed over the Mayor's veto by a unanimous vote, but is now slumbering in committee rooms of Council, who seem determined to pass only such a bill as will be of present and future good to St. Louis. The recent decision of United States Supreme Court has been announced in good season to do effective work in the fight, and has had a healthy effect in offsetting the wild actions of the 'unanimous House.' It became painfully evident to some of the hot heads, who are laboring for the dear 'public,' that the old companies had some rights which (though they did not respect) could be enforced.

"Bro. Howard, of Dubuque, Ia., has been 'fooling' with the Cooper Coal Liming Process, and 'comes up smiling,' but about as well 'floured' (or floored) as Bro. Somerville. 'Jerry' will tell all about it at Columbus next May. Retort."

Many items stand over to next issue.

The Market for Gas Securities.

The market for city gas shares has latterly been in a sort of shaky condition, the why and wherefore of such shakiness being rather difficult to trace up. Consolidated gas has declined to 96⅛ on somewhat free offerings; but those in position to know whereof they speak confidently assert that the volume of sales reported from Stock Exchange contain copious examples of the "washing" process. About this time a year ago the best bid price obtainable for Consolidated was 82½, while buyers' options on the shares were in slight demand at 85. The Senate Committee now engaged in an "investigation" of the consolidation appears to be going pretty much over the same ground that was "ploughed up" last spring; and about the only really tangible matter "unearthed" by them so far is the weeding out of farmer Sherwood's crop of spite—for, and from his own admission, nothing other than spite has been at the bottom of his puny warfare against the chief suppliers of gas in New York city. Investors appear to favor the notion that the Albany solons will, during the coming session of the Legislature, repeat the tactics pursued in 1885; and this view is also put forward in accounting for the weakness displayed by Consolidated quotations. However, those who followed the advice given in this column during the past year have little to reproach themselves with. Highest and lowest figures recorded for Consolidated during the year range between 105 to 79½, respectively. Mutual company, city, pay a regular quarterly dividend of 2½ per cent. on January 16. Equitable, city, bonds are quoted at 110 to 112. Brooklyn shares are steady to strong. The Fulton Municipal Company, Brooklyn, pays a regular quarterly dividend of 3 per cent. on Jan. 15. Chicago (Ills.) old company's stock is freely bid for at 133, with offerings at 136. These figures show surprising strength. Taken as a whole the gas share market for 1885 has been perfectly satisfactory to investors in such securities. At auction, city, 1,750 shares Havana (Cuba) Gas Light Company, at 8¼–9.

Situation Desired

As Superintendent of Gas Works.

Good recommendations as to character and ability. Address

637-3t "M. R. L.," care this Journal.

MITCHELL, VANCE & CO.,

MANUFACTURERS OF

Chandeliers

and every description of

GAS FIXTURES.

Also manufacturers of Fine Gilt Bronzes and Marble Clocks, warranted best time-keepers. Mantel Ornaments, etc.

Salesrooms, 836 Broadway, N. Y.

Special Designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, etc.

WANTED, BY A CAPABLE MAN,

A situation as Fitter, Engine Driver, or Main Layer. Can accomplish any sort of fitting required about a gas works. Is competent to take charge of a small gas plant. Has had fourteen years' experience in the gas business. Address

JOSEPH ANGEL, 19 St. Catherine Street,

637-1t Montreal, Canada.

SITUATION WANTED

As Rental Clerk,

By a young Englishman. Has had four years' experience in large London Company, and fully understands the business. Good references. Address

637-1t "G. W. T.," Toms River, N. J.

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New and Improved Regenerative Furnace.

ESPECIALLY ADAPTED FOR USE IN SMALL GAS WORKS.

A Saving of at Least Forty per Cent. over Old Methods.

Cheapness of construction and absence of elaboration are the chief characteristics of this Furnace. It is also applicable in cases where it is not convenient to excavate deeply below the line of the retort house.

Correspondence respectfully solicited. Descriptive Circulars on application.

Manhattan Fire Brick & Enameled Clay Retort Works.

OFFICE, 633 EAST FIFTEENTH STREET, N. Y. CITY.

The Albo-Carbon Light!

A new system of Carburetting heated Gas by means of a solid material, whereby its illuminating power is increased more than three-fold.

SUPERIOR TO ALL OTHER SYSTEMS FOR

Economy, Safety, Illuminating Power and General Practicability,

The Albo-Carbon process enables Gas Companies to supply a light equal to the Arc Light, at a much less cost. Several Gas Companies are now using this system. The process is extensively used in Europe, and is being rapidly adopted in this country.

The Albo-Carbon Light Co., - - Newark, N. J.

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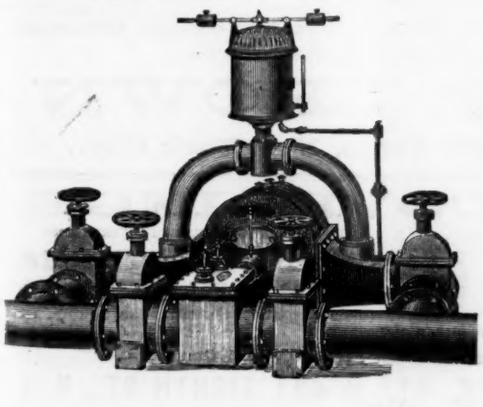

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Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.

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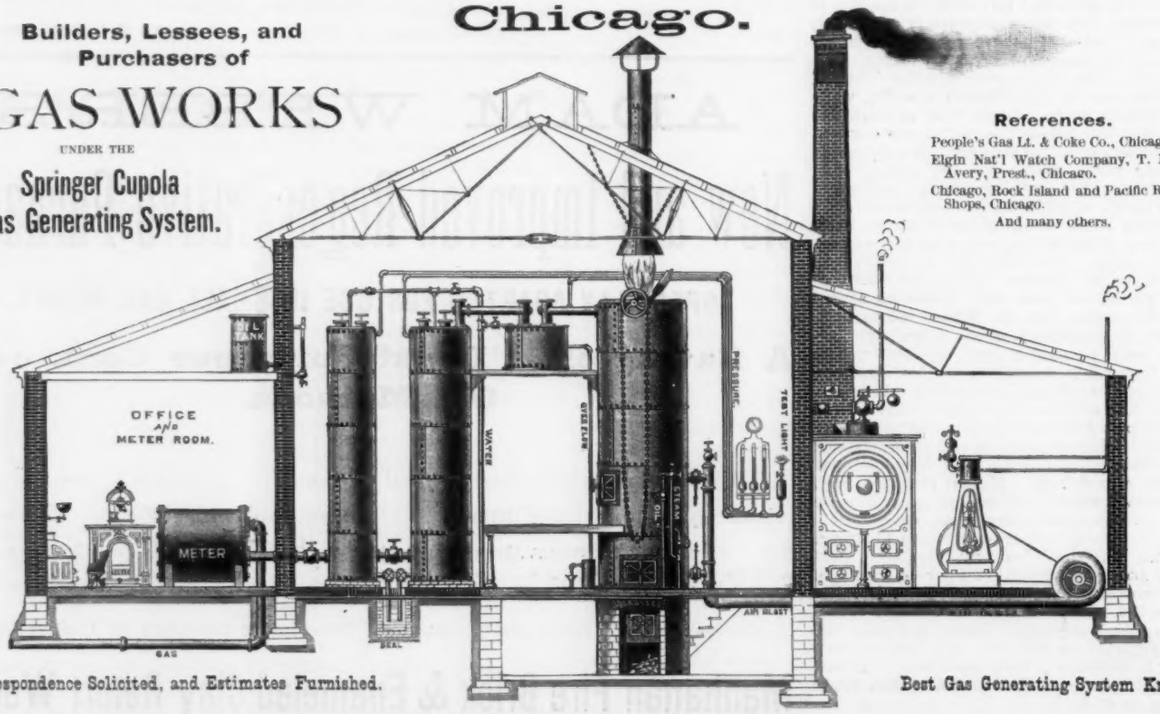

References.

People's Gas Lt. & Coke Co., Chicago.
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Best Gas Generating System Known.

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LOOMIS'S PATENT WATER GAS APPARATUS, FOR MAKING ILLUMINATING OR HEATING GAS FROM BITUMINOUS SLACK, ANTHRACITE COAL SCREENINGS, COKE, LIGNITE, OR WOOD.

More gas can be made with this apparatus, using BITUMINOUS SLACK, than by any other process using same amount of best quality Anthracite Coal, and with less oil. No clinker; no filling up of superheater with ashes, as they are separated from the coal in the process of blasting and easily removed. Plans and estimates furnished.

Taylor's AUTOMATIC GAS CHECK.

Pat. Sept., 1885. Just the thing for street lamps. No moving parts; only the gas moves, and checks itself by opposing currents; cannot get out of order or wear out; the cheapest and best of all governors. Samples, by mail, 10 cents. Send for circular.

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The Forest City Naptha Co.,

REFINERS OF

NAPTHA AND GASOLINES.

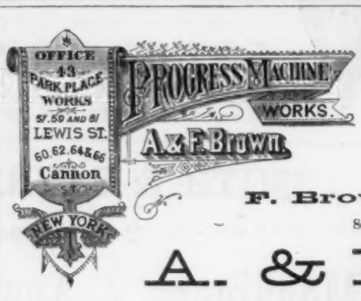
ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.



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Made in sections three feet long. Easy to apply; light and cheap.

Asbestos Materials, Fibre, Braided Packing, and Cement.

CHALMERS-SPENCE COMPANY, 419 & 421 EIGHTH ST., N. Y.

CONNELLY'S AUTOMATIC GOVERNOR FOR STREET MAINS.

We give herewith a few late letters from gas companies using our Governor, and also a cut (exact reproduction) of two pressure sheets from the Peoples Gas Light Company's Works, Cleveland, Ohio. A careful inspection of the cut will reveal more concerning the Governor's accuracy and reliability than we could express in all the columns of the JOURNAL. It shows clearly that the Governor is endowed with more than human intelligence, and fully verifies a late remark of a certain "Western Member"—"Connelly's Governor is *brains in iron.*" In explanation of the very light day pressure (3-tenths) carried by the Peoples Gas Lt. Co., Cleveland, we will say that their entire district is quite level, and at an elevation of 73 feet above the gas works; and 3-tenths pressure at the works gives them about *one inch* pressure throughout their district.

The Governor shows a finer discrimination than human intelligence is capable of. We do not boast of what our Governors "can" or "will" do, but submit evidence of WHAT THEY ARE DOING! We now have 43 of these machines in practical operation, and experience has taught us that a machine so delicate and sensitive in its construction, liable to be placed under such widely varying conditions, *cannot be perfected on paper.* Our late improvements enable us to send out a Governor to *any works*, capable of being adjusted to any possible conditions or requirements after it is in place. A 20-inch Governor can be sent to one works and adjusted to hold 3-tenths day and 40-tenths night pressure, and its duplicate or counterpart may be sent to another works having same consumption and initial pressure, and be set to hold 10-tenths day pressure and 11-tenths night pressure—both working perfectly as desired. Such range of adjustment is absolutely necessary in an Automatic Governor, not only to secure the desired action in the beginning, but to be prepared to meet the new conditions sure to follow the building of a heavier holder or a large increase in capacity of the mains. No Governor in this country or abroad, in use or illustrated on paper, is constructed with such a range of adjustment, and to secure it would require a radical change in principle.

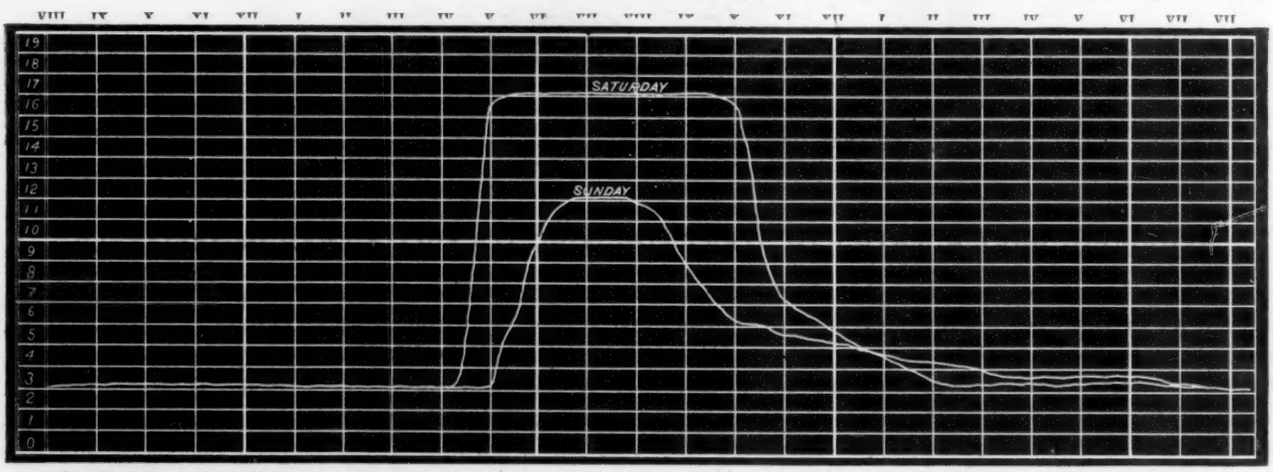
Another important feature of our Governor *not found in others* is the *absolute impossibility of the valve sticking in its seat* and shutting off the gas. We do not permit the valve to *enter* its seat; it is so constructed that it bears at *right angles* on a knife-edge seat, and must fall away from it when its supporting pressure is reduced in the least degree. The great value of this feature will impress itself on the careful Gas Manager. In short, our experience has enabled us to meet every possible requirement in Automatic Governors (as the accompanying letters attest), and we can unhesitatingly guarantee every Governor sent out to give perfect satisfaction in every respect, or will remove same at our expense. It is useless for us at this late day to waste any words on the *economy* and *satisfaction* derived from such a machine; and no progressive Engineer or Superintendent would to-day plan a works without locating an Automatic Governor. As they are finely finished and highly ornamental, their proper place is in the Office or Meter Room. As one of these Governors will *save its cost* in a short time, no company should hesitate to place one. The more perfect distribution and satisfaction given consumers are additional advantages that cannot be estimated in dollars and cents. We publish below a few letters, and will publish others in the following numbers of the JOURNAL.

CONNELLY & CO., Ltd., 407 Broadway, N.Y.

PEOPLES GAS LIGHT COMPANY, 412 PEARL STREET, CLEVELAND, OHIO, Dec. 7, 1885.

Messrs. CONNELLY & CO., LTD., 407 Broadway, N. Y. City—Gentlemen: Inclosed find pressure register sheets for Saturday and Sunday, December 5 and 6, corroborating my statement in previous letter that your Governor "*does its work perfectly.*" No more can or need be said.

Very truly yours, EDWARD LINDSLEY, Eng'r and Supt.



Card Showing Pressure at Peoples Gas Co.'s Works, Cleveland, Ohio, for Dec. 5 and 6, 1885.

Augusta, Ga.

OFFICE GAS LT. CO. OF AUGUSTA, GA., Nov. 28, 1885.

Messrs. CONNELLY & CO.—Gentlemen: In reply to yours of 24th inst., we would say we have had your Automatic Governor in use about eight months. In that time it has always done its work well; it is no eye servant—it requires no watching; in fact, it is the only Automatic Governor that has ever come to my notice. Knowing its value as I do, I can honestly say I would not be without it if its cost was ten times as much. I look upon it as one of the very best investments I have ever made for my company.

Yours very truly, G. S. HOOKEY, Supt.

Greensburg, Ind.

GREENSBURG GAS LT. CO., GREENSBURG, IND., Oct. 17, 1885.

Messrs. CONNELLY & CO., LTD.—Dear Sirs: In answer to yours of the 15th, I will say that we are well pleased with our Governor, and would not do without it under any circumstances. It "fills the bill" in every respect.

Yours, W. S. SMITH, Supt.

Lima, Ohio.

LIMA GAS LT. CO., LIMA, OHIO, Nov. 7, 1885.

Messrs. CONNELLY & CO., LTD.—Gentlemen: In reply to yours of the 6th inst., would say that your Governor is giving entire satisfaction—doing all that you claim for it. Hoping this is satisfactory, I remain,

Yours respectfully, W. H. GIBSON, Supt.

Danville, Ill.

DANVILLE GAS LT. CO., DANVILLE, ILL., Nov. 9, 1885.

Messrs. CONNELLY & CO.—Gentlemen: In reply to yours of 7th inst., I would say that I have had one of your Automatic Governors in use about two months. Since setting up and adjusting it has required no attention whatever except a little oil once a week. Thus far it has performed its work admirably, and always on time. Yours respectfully,

J. H. WOODMANSEE, Supt.

Bethlehem, Pa.

BETHLEHEM GAS LT. CO., BETHLEHEM, PA., Nov. 1st, 1885.

Messrs. CONNELLY & CO.—Gentlemen: I wish to say to you that we are glad the delay occurred in the delivery of our Governor, inasmuch as you sent it with the new improvements added. It is a satisfaction to us to know that we waited exactly long enough before buying, and that we did buy exactly what we wanted. Yours very truly, A. H. RAUCH, Supt.

Frankfort, Ky.

CAPITAL GAS AND ELECTRIC LT. CO., FRANKFORT, KY., Nov. 9, 1885.

Messrs. CONNELLY & CO., LTD.—Dear Sirs: Replying to your favor of the 7th inst., will say that we have been using one of your Improved Automatic Gas Governors for nine months, and find that it is just what it is represented to be—a perfect Automatic Governor. Respt. yours, S. J. SHEA, Supt.

Athens, Ohio.

ATHENS GAS LT. CO., ATHENS, OHIO, Nov. 9, 1885.

Messrs. CONNELLY & CO.—Gentlemen: Your favor inquiring after the working of the Connelly Governor received. It has now been in use more than a year, and we find it as recommended in every particular. It does all the work required of a Governor, and strictly *automatically*. I have not the first disadvantage to suggest, after a trial at all seasons of the year. We consider this investment the most profitable and economical of any about our works, and have recommended it to all inquirers. Our leakage account has been reduced one-half. Yours very truly, C. H. WELCH, Supt.

THE CLERK GAS ENGINE.

Highest Award American Institute, New York, 1883. Silver Medal American Institute, N. Y., 1884.
Gold Medal Awarded Crystal Palace Electrical Exhibition, London, 1882.
Highest Award for Motive Power British Section International Exhibition of Electricity, Paris, 1881.

Reliable.

No Boiler.

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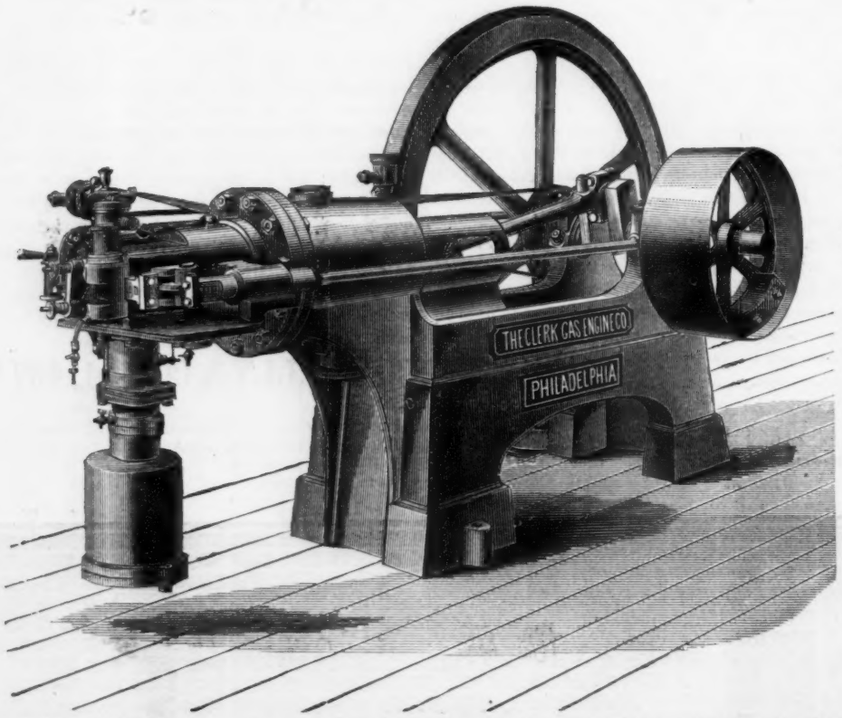
No Ashes.

Compact.



Economical.

No Engineer.

No Explosion

No Gearing Wheels.

No Danger.

No Parts requiring frequent renewal.

REQUIRING ONLY A MATCH TO START IT--GIVING ITS FULL POWER IMMEDIATELY.

We would inform the public that during the last few months we have improved THE CLERK GAS ENGINE to such an extent that we can now offer an engine vastly superior to our former pattern. These improvements have enabled us to sell our engine at a GREATLY REDUCED FIGURE, partly on account of the decreased weight (our engine weighing about half that of others giving the same Brake H. P). The consumption of gas has been decreased to a considerable extent, and the Brake H. P. has been increased some 25 to 30 per cent. All parts of the old design that were considered defective have been remodeled and new designs added. We now have an engine second to none as regards power, consumption, and ease of working. With our new engine all trouble in starting has been removed, the noise reduced to a minimum, and the regularity of motion is now all that can be desired. We guarantee all we claim for it, and the material and workmanship being of the best, enables us to guarantee the engine for twelve months.

SOLE MAKERS,

THE CLERK GAS ENGINE CO.,

WM. W. GOODWIN, President. E. STEIN, Secretary. S. LEWIS JONES, Asst. Secretary. L. P. GARRET, Supt.

Main Office, 1012-1018 Filbert Street, Philadelphia, Pa.

BRANCH OFFICES,

142 Chambers St., N. Y. 4 West Fourteenth St., N. Y. 76 Dearborn St., Chicago

General Agents,

THE GOODWIN GAS STOVE & METER CO.

Of Philadelphia, New York, and Chicago.